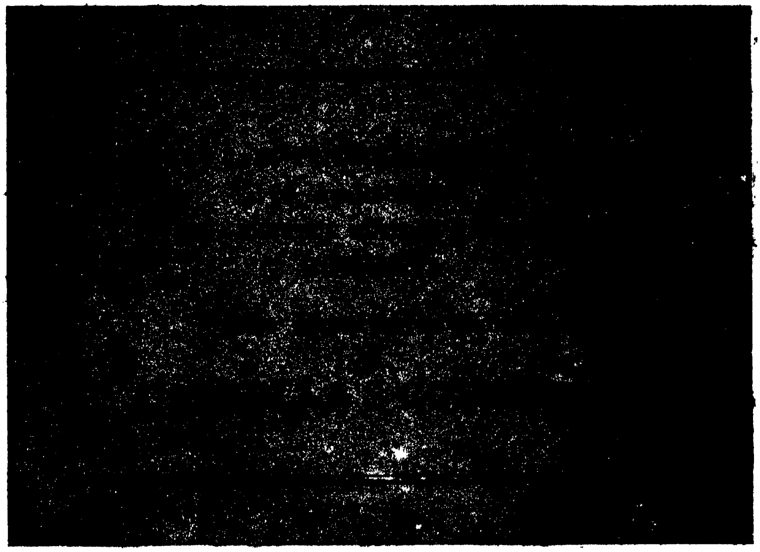
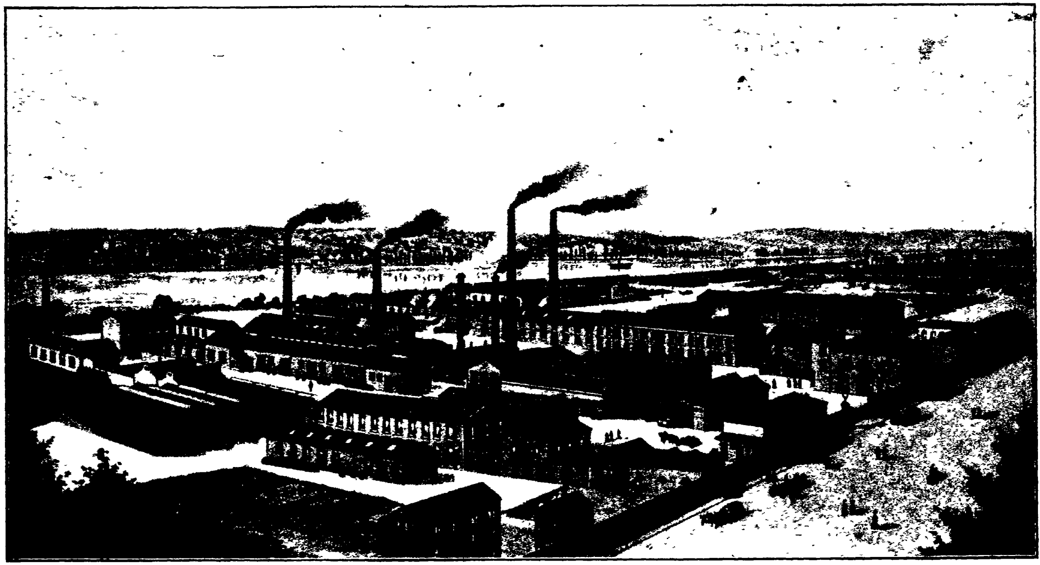
DIRECTOR OF INDUSTRIES
LIBRARY
JAN. 1923
BENGAL.



MANUFACTURE LYONNAISE DE MATIÈRES COLORANTES.

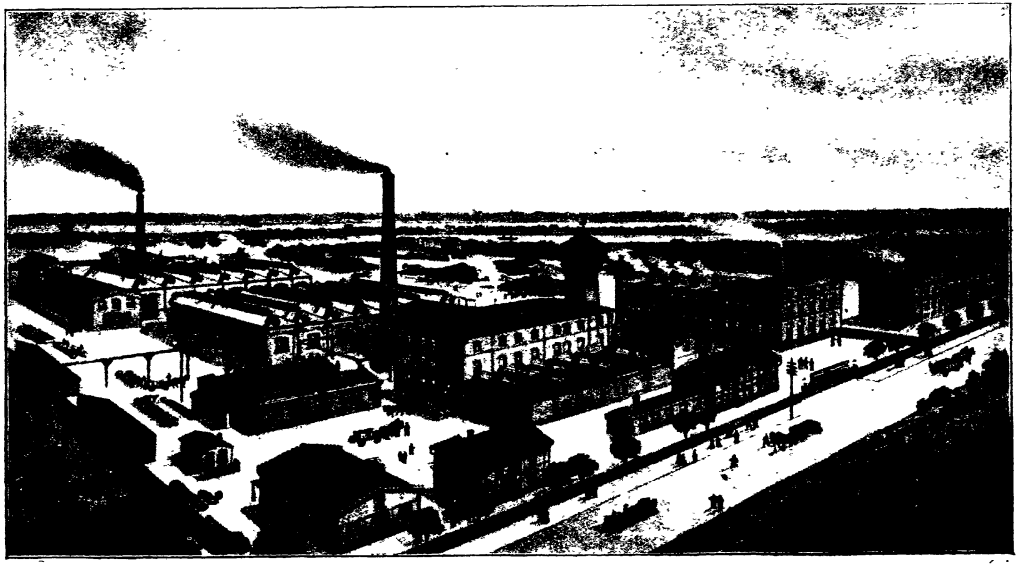
Branch in France.



Aniline Colour Works: "La Mouche" near Lyons.

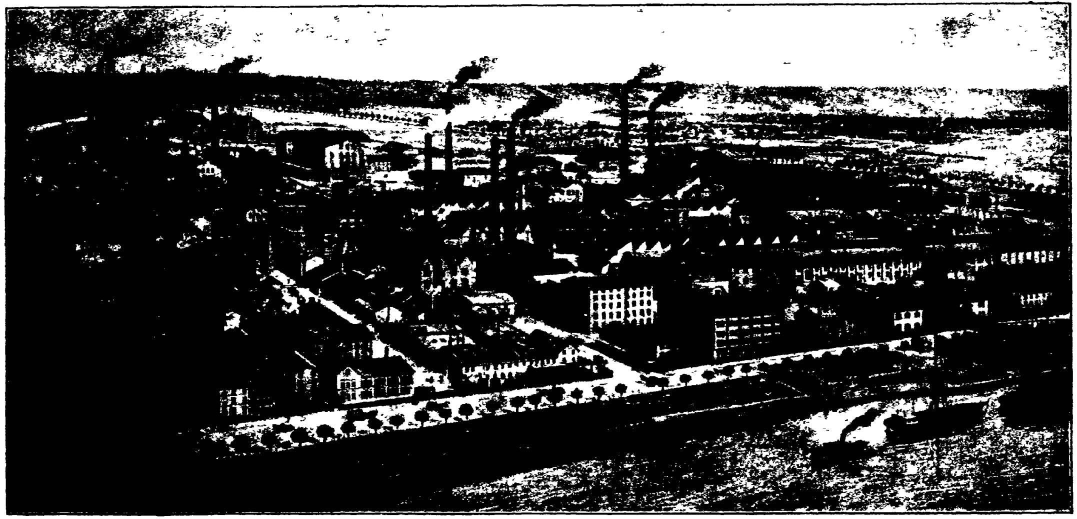
RUSSISCHE ANILINFARBEN-FABRIK LEOPOLD CASSELLA & Co. AT RIGA.

Branch in Russia.



Aniline Colour Works at Riga.

LEOPOLD CASSELLA & Co. G. m. b. H. FRANKFORT o. M.



Aniline Colour Works at Mainkur near Frankfort o. M.

The Dyeing of Cotton

with the dyestuffs of

LEOPOLD CASSELLA & Co.

G. m. b. H.

ANILINE COLOUR MANUFACTURERS

FRANKFORT o. M., (GERMANY).

TRADE MARK.

Revised and enlarged Edition.

Preceded by an introductory Chapter on
The Outfit of a Dyehouse.

Frankfort o. M. and Bombay.
1909.

Printed in Germany.

With

Messrs.

Leopold Cassella & Co.

G. m. b. H.

Best Compliments!

Preface to the first Edition.

We have great pleasure in placing before our Indian friends this book of "Instructions for Dyeing Cotton Materials", which has been especially composed with a view of meeting the requirements of our Indian customers. We are well aware that information on technical matters is not always attainable in India, and it is from this point of view, that we undertake the edition of this pamphlet. We therefore think it appropriate, to give the most minute instructions concerning the different dyestuffs and their methods of application.

We also consider it useful to give some general remarks about the arrangement of a dyehouse such as it ought to exist at every Indian Cotton Spinning and Weaving Mill. We have many a time had occasion to observe that the dyeing department of Indian Cotton Mills is very much neglected, naturally to the disadvantage of the Mill. It stands to reason that a thoroughly handy outfit, however simple, is the only means to obtain good and regular results.

Frankfort o. M. and Bombay.

Leopold Cassella & Co.

Preface to the revised and enlarged edition.

The book on "Cotton Dyeing" we published a few years ago for the use of our Indian friends has met with their unanimous approval and the great and constant demand for it has convinced us that we have done a valuable service to our customers by editing the work.

The book being now out of print and to satisfy frequent requests we have decided to publish a new edition.

Cotton dyeing, however, has made great progress during the short time elapsed and the Immedial Colours which were still in the experimental stage when the first edition was published, owing to their very simple method of application and excellent fastness to all influences have attained the greatest significance and are now well known in Indian dye-houses. Paranitraniline Red also for the same reasons has acquired great importance and has replaced Alizarine red for many applications. We have therefore deemed it appropiate to discuss the Immedial Colours and Paranitraniline Red in our book and so to enlarge it to a compendium of modern cotton dyeing.

Frankfort o. M. and Bombay, January 1909.

Leopold Cassella & Co.
G. m. b. H.

Index.

Introduction.

Chapter I.

The Dyehouse.

Page
Situation. — Building. — Drainage. — Steam and water pipes. . 1—4
Outfit for yarn dyeing. — Vats. — Arrangements of steam pipes in vats — Immedial vats. — Vessels for dissolving colours. — Dye sticks. — Racks. — Stretchers. — Yarn rests and carriers — Yarn washing machines. — Hydro-extractors. — Drying rooms. — Yarn drying machines. — Scales. . . . . 5—17
Outfit for loose cotton dyeing. — Vats. — Dyeing machines. — Washing machines. — Drying rooms. . . . . 18—21
Outfit for piece dyeing. — Open vat. — Jigger. — Immedial jigger. — Padding machine. — Continuous dyeing machines. — Piece washing machines. — Drying machines. — Steam chest. — Laboratory. — Dyeing master. . . . . 22—29

Chapter II.

Preparation of the material previous to Dyeing.

Impurities in the material. — Boiling and bleaching of yarn. — Boiling and bleaching of cloth. . . . . 31—36

Chapter III.

Application of the Diamine Colours for Cotton Dyeing.

Dissolving the dyestuffs. — General remarks on dyeing. — Effect of neutral and alkaline salts. — Quantity of water. — Indirect steam. — The salts used in dyeing. — Temperature. — Exhaustion of the dyebath. — Dyeing in consecutive lots. — Aftertreatment with metallic salts. — Sulphate of copper. — Chromium fluoride. — Bichromate. — Copper-chrome. — Other salts. — Diazotising and developing. — Developers. — Mixing of developers. — Practical diazotising and developing. — Schaeffer salt. — Soda passage. — Topping developed shades. — Coupling. — Topping with Basic Colours. — Topping with Aniline Black. . . . . 37—60

Chapter IV.

Application of the Diamine Colours in Dyeing Loose Cotton.

Page
Advantages of the Diamine Colours. — Methods of dyeing. . . 61 65

Chapter V.

Cotton Hank Dyeing with the Diamine Colours.

Dyeing at full boil one hour. – Dyeing at full boil for one hour and working afterwards in the cooling bath. – Dyeing in consecutive lots. – Dyeing in consecutive lots and aftertreating in consecutive lots. – Dyeing pale shades. – Dyeing very light compound shades. – Washing and drying dyed Yarn. 67 76

Chapter VI.

Application of the Diamine Colours in Piece Dyeing.

Deing in the open vat. – Dyeing on the Jigger. – Diazotising and developing. – Aftertreatment with metallic salts. – Topping with Basic Colours – Dyeing in the padding machine. – Dyeing in the continuous dyeing machine. . 77– 89

Chapter VII.

Application of the Basic Colours in Cotton Dyeing.

Basic Colours and Mordants. – Tannin. – Antimony, iron etc – Dyeing. – Mordanting cotton yarn. – Mordanting loose cotton. – Mordanting cotton piece goods. – Dissolving Basic Colours. – Dyeing with Basic Colours – Dyeing with Naphtindones. . . . . 91 - 102

Chapter VIII.

Immedial Colours.

Dissolving and Dyeing. – Aftertreatment of the Immedial Colours. – Shading Immedial Colours with Diamine or Basic Colours. – Dyeing Immedial Colours in a cold or lukewarm bath. –

Page

Immedial Colours on loose cotton. – Bottoming with Immedial Colours, and topping with Basic Colours. – Bottoming with Immedial Colours, and topping with One-dip Aniline Black. – Softening loose cotton. – Immedial Colours on cotton yarn. – Steaming of Immedial Blue. – Bottoming with Immedial Colours, and topping with One-dip Aniline Black. – Bottoming with Immedial Colours, and Topping with Indigo. – Immedial Colours on piece-goods. — Dyeing in the jigger. – Black, Blue, etc., Pale Mode Shades, Militay-Grey, Khaki. — Dyeing in the padding machine. – Dyeing in the continuous machine. – Developing of Immedial Blue or Immedial New Blue. – Aftertreatment with metallic salts. – Aftertreatment with acetate of soda. – Topping Immedial Colours with Indigo. . . . 103—131

Chapter IX.

Paranitraniline Red.

Introduction. – Paranitraniline Red on cotton yarn. — Mordanting. Developing. – Paranitraniline Red on cotton piece goods. — Mordanting. – Developing. – Patterns of Paranitraniline Red. 133–143

DIRECTOR OF INDUSTRIES
LIBRARY
JAN. 1923
BENGAL.

Chapter I.

The Dyehouse.

Situation. The dyehouse should be situated near the water, river or pond and near the steam boiler. It is also very important to have an abundant water supply, also to be able to get easily rid of the waste water. Of course the vicinity of the boiler house is desirable so as to avoid condensation of steam in the steam conduit.

Building. For a daily production of about 2000 lbs. to 3000 lbs. of yarn or loose cotton and about 1500 lbs. of cloth, the dyehouse ought to be 120 feet by 70 feet. Good light and good ventilation are most important The height of the walls must be at least 16 feet. The proper construction of the roof is especially in India a matter of great consideration. The best way is to make two overlapping, moderately slanting roofs, as is done in many buildings in hot countries. Besides these two roofs there must be a tower-like opening all along the top of the dyehouse, through which the vapour can escape. We give below a sketch of such a roof.

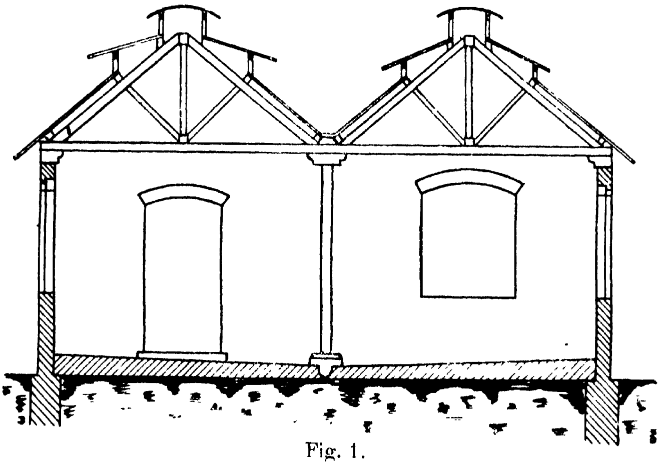


Fig. 1.

Drainage.

The floor must be paved and sloping towards the drain, which may be in the middle or at the side of the dyehouse. The inclination must be $^1/_2$ to $^3/_4$ inch per one foot, so that all waste liquor, water etc. runs into the drain instantly. The drain is covered with perforated cast iron plates.

Steam and Water pipes.

Steam and water pipes must be accessible at any part of the building and power is of course required for working the jiggers, padding machines etc., washing machines and hydro-extractors. It is advisable to set apart one side of the dyehouse for all the machinery which requires power and to run a shaft through this part along the roof, so that all machines can be easily connected with this shaft.

I. Outfit for Yarn Dyeing.

Vats.

Yarn is boiled and dyed in wooden vats, made of well seasoned teak-wood planks of 2″ to 3″ (inches) thickness and joined by iron bolts. The size of the vats varies, of course, according to the quantity of yarn to be dyed in one lot.

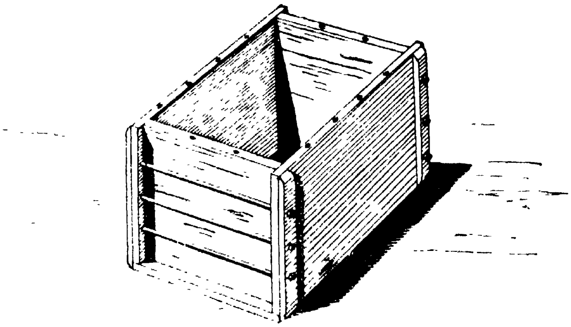


Fig. 2.

Heating by closed steam.

The vats are fitted with a closed (not perforated) copper steampipe*) of $1^1/_2$″ to 2″ diameter, which runs in the form of a W on the bottom of the vat and passes out in a corner in shape of a tapering pipe, ending on the floor for the discharge of the condensed water. This pipe is provided with cocks or better with brass valves, and should be properly fastened to the vat by means of metal clasps. In addition to the closed steam-coil an open steampipe will be useful for the rapid heating of liquors, for boiling yarns etc. and this may be provided by branching off from the main pipe an additional short pipe which is open at the end.

---

*) Regarding vats for Immedial Colours see page 8.

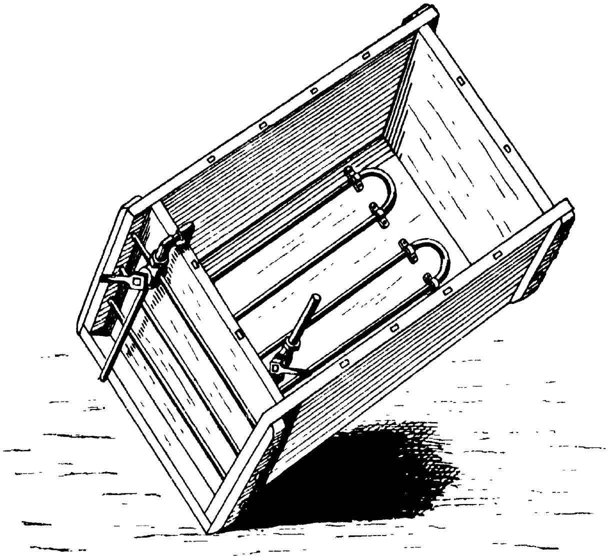


Fig. 3.

To fill the vats rapidly the water pipe should have a large tap above every vat; the pipe should be 2″ to 3″ in diameter, the taps of corresponding size.

In one corner of the vat a waste valve is fitted in, which allows emptying the vat rapidly

Sketch No 4 illustrates the various features of the dye vat.

S is the steampipe coming from the main conduit.

D is the pipe for boiling with direct steam.

C is the W-shaped **closed** pipe for indirect steam and

E the discharge valve for condensed water.

A is another steampipe branched off **outside** the vat, for heating water, colour solutions etc. in a bucket.

V is the waste valve.

F are the outside iron bolts and

G the inside iron bolts to hold the vat tight together.

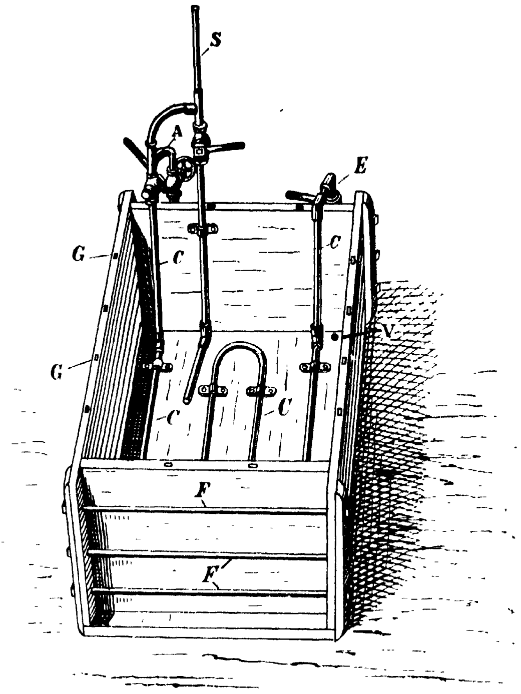


Fig. 4.

Sizes of Vats.

The most convenient sizes of vats are the following:

For boiling yarn: 6 feet long, 4 feet broad and 6 feet deep, all inside measurements. Such a vat will be large enough for boiling 500 lbs. of yarn made up in chains as usual.

For dyeing yarn: A vat 9 feet long, $2^{1}/_{2}$ feed wide and 2 feet deep, all inside measurements, will be suitable for dyeing 100 lbs. of yarn in dark shades or 75 lbs. of yarn in light shades, or 50 lbs. of yarn in very pale shades. A vat of 5 feet length, $2^{1}/_{2}$ feet width and 2 feet depth - inside measurements - will be useful for dyeing 50 lbs. of yarn in dark colours.

Immedial-Vats.

Immedial Colours are dyed in the same kind of barks which, however, must not contain any parts made of copper or brass. The fittings and steam pipes are best made of iron, lead or hard lead. In order to ensure the production of level colours, it is recommended to squeeze off the hanks on lifting and for this purpose the barks are usually supplied with a pair of nippers of very simple construction.

Following we give sketches of dye-vats with squeezing-rollers of the usual type Fig. 5 and 6.

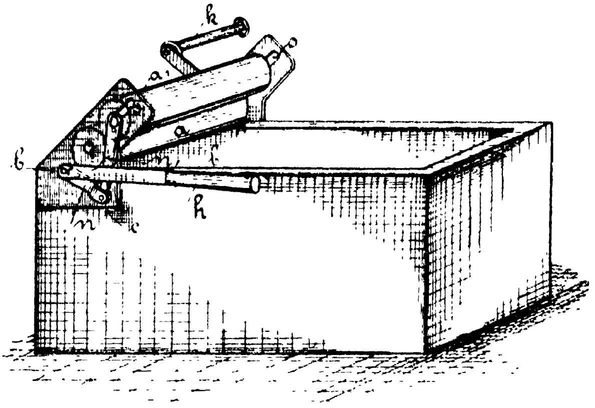


Fig. 5.

Fig. 5. An iron cheek with bearings for the rollers *(a)* and *(a1)* is fixed on each long side at one end of the bark, the bearings of the top roller being so adjusted as to move in slots *(s)* when the roller is lifted or lowered.

The top roller is raised and lowered by means of the arm of a lever *(h)* in connection with a knee-joint lever *(n)* and *(m1)*.

The levers *(h)* and *(n)* are firmly joined at *(b)*, whilst there is a moveable joint at *(c)* for the levers *(n)* and *(m1)*. A similar arrangement, but without the lever arm, is fitted to the other side. Both sides are connected by a shaft, passing through *(b)* right across the bark, by which the lifting and the lowering of the top roller proceeds simultaneously from both sides. The bottom lever is provided with a crank *(k)*.

The method of working is a follows:

After completing the dyeing proper, the top roller *(a)* is lifted by raising the lever *(h)*, the stick carrying the yarn is passed between the two rollers and the yarn laid upon the bottom roller. While one man is pressing down the lever *(h)*. another turns the crank *(k)* and the yarn thus passes between the rollers and is freed from the bulk of the adhering liquor.

Another way of arranging the squeezing rollers is illustrated in the sketch below (Fig. 6).

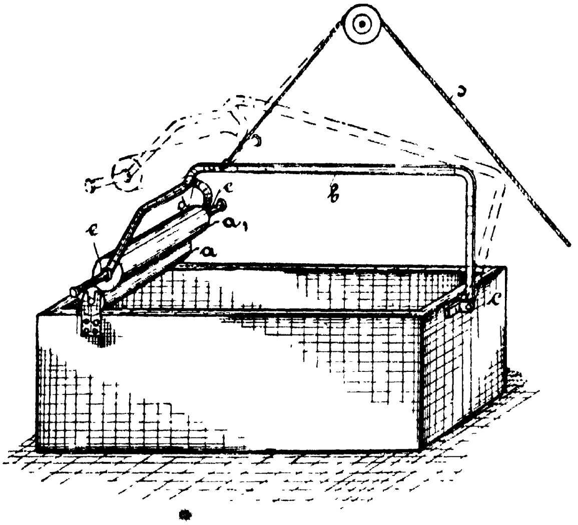


Fig. 6.

One of the narrow ends of the box is provided with a roller *(a)*, the opposite end carries an iron arm joined at *(c)* which extends over the length of the bark and is forked at *(d)*. The lower ends *(e)* of the fork carry the bearings for a second roller (a_1). Arm and roller (a_1) can be raised together by means of the rope *(s)*.

The dyeing proper being completed, the arm is lowered until the roller (a_1) rests upon the lower roller *(a)* and the yarn is passed through, stick by stick, a raising of the top roller being thereby unnecessary.

Hot water for solutions.

It will be found very convenient to have a number of barrels (say Kerosene casks), placed in a convenient spot, fitted, with water- and steam-pipe, in which water is kept boiling and ready to dissolve colours. See sketch 7.

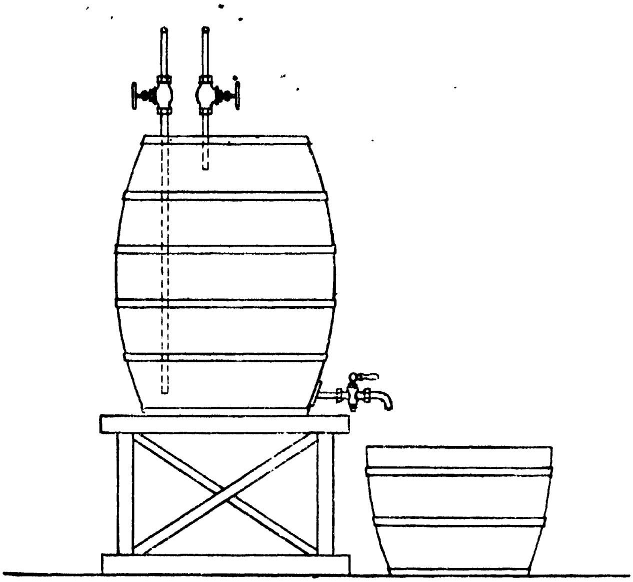


Fig. 7.

Correcting hard water

For all Diamine, Immedial, and other direct dyeing colours, Beta-Naphtol etc., this water must be corrected by adding a little soda-ash, ½ oz to 2 ozs per 20 gallons according to hardness of water, and repeating this addition in proportionate quantities on adding fresh water. For dissolving such chemicals as sulphate of copper (blue vitriol), copperas, chrome-alum, chromium fluoride, bichrome etc., the water should be corrected by the addition of a little acetic acid.

It is advisable to indicate the contents of every bucket by painting an "S" on those containing water corrected with soda-ash, and an "A" on those the water of which is corrected with acetic acid.

Vessels for dissolving colours.

For dissolving colours and chemicals a number of large buckets, made of wood, copper*) or galvanized iron are necessary. If larger quantities of colour, say a few pounds at a time, are to be dissolved, then a larger vessel should be taken. In most cases half barrels (for instance Oil barrels cut in two) will be found very useful. See sketch 7 (page 10).

---

*) The solutions of Immedial Colours must not come in contact with copper.

Also a few free steampipes (either rigid or moveable) should be fixed up at convenient places, so that the buckets or casks containing the colour solution can be placed under the steampipe and boiled.

These steampipes may be branched off from the steampipes of the dye vats as indicated in sketch 6.

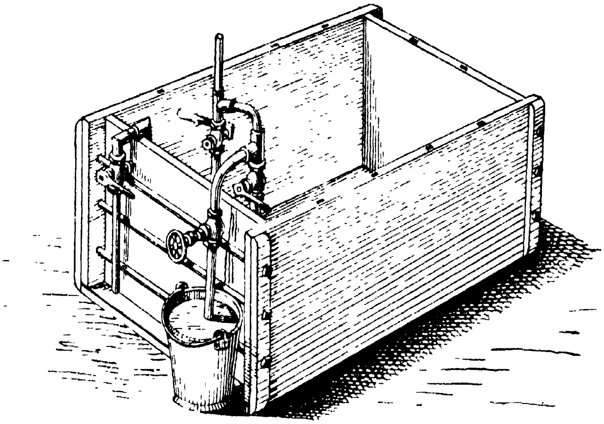


Fig. 8.

Dissolving.

To dissolve for instance 6 lbs. of any Diamine Colour, the following method is employed. Put the dry powder into one of the half casks, pour a few gallons of boiling water out of the "S" cask (i. e. water corrected with soda-ash) over it and stir the solution with a stick. See sketch 7. Then place the bucket under one of the free steampipes and boil the contents slowly for a short time, when the colour will be completely dissolved. See sketch 8.

Soda and salt are dissolved in the same way. Sulphate of copper and bichromate of potash however are dissolved with water from the "A" cask (water corrected with acid).

Dye sticks.

A good supply of dyesticks and broaching sticks for handling the yarn during the dyeing process is required. The dyesticks on which the yarn to be dyed is suspended, are smooth wooden rods of special shape (sketch 9) $3^{1}/_{2}$ feet long, $^{3}/_{4}''$ thick and $2^{1}/_{2}''$ broad. They are made of closely grained wood, standing heat well. During the dyeing operation the hanks of the yarn are turned by means of a broaching stick, i. e. a round stick $3^{1}/_{2}$ feet long and tapering from $1^{1}/_{8}''$ to $^{3}/_{4}''$ in thickness (resembling a billiard cue in shape), see sketch 9.

Bent pipes. Immedial Colours are dyed with advantage on bent pipes as described on page 117.

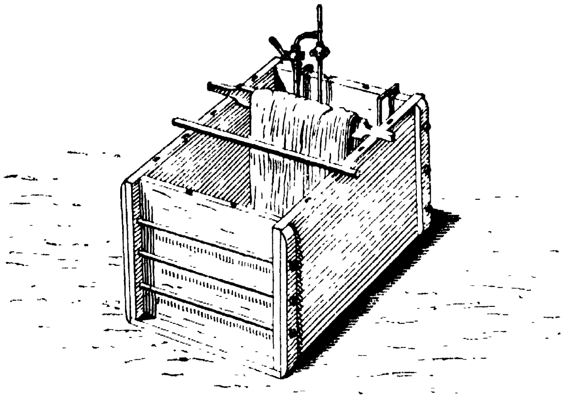


Fig. 9.

Racks. The various solutions are mixed in the dye-bath by means of wooden racks, of which a small number are required. The shape of the racks is shown in the following sketch No. 10.

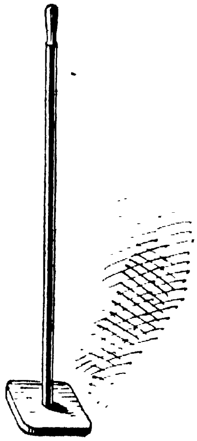


Fig. 10.

Stretchers. For wringing the yarn, a number of so-called stretchers, i. e. wooden posts with round poles, are fitted up somewhere near the dyevats used for yarn dyeing. The yarn is suspended on the horizontal poles and stretched or wrung by means of round wooden sticks, 2 feet long and $2^1/_2''$ in diameter; sketch 11.

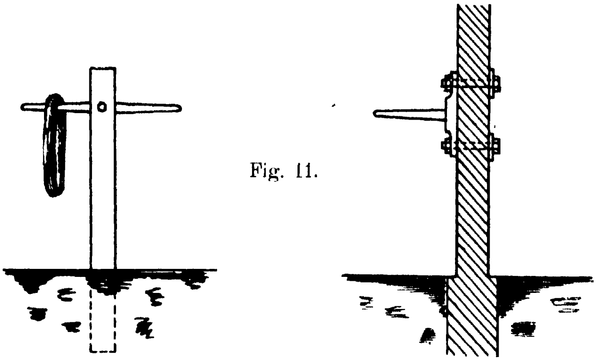
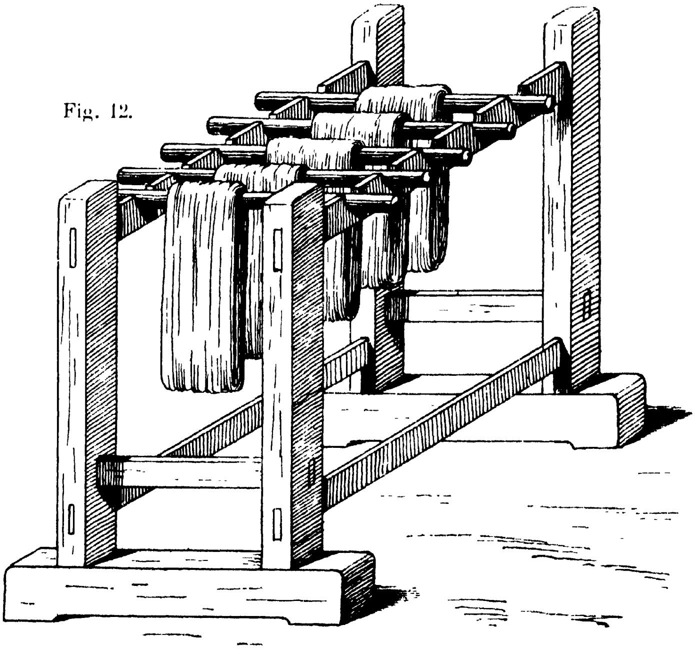


Fig. 11.

Yarn Rests.

Yarn placed on the dyesticks for draining or to wait for other operations is best put on yarn rests which consist of a pair of beams supported by wooden feet as shown in sketch 12. These beams may be 5–10 feet long, 3–5″ thick and about 4 feet from the floor.

Fig. 12.



Yarn Carriers. For carrying yarns, particularly wet yarns, special wooden yarn carriers are used, in shape as shown in sketch 13.

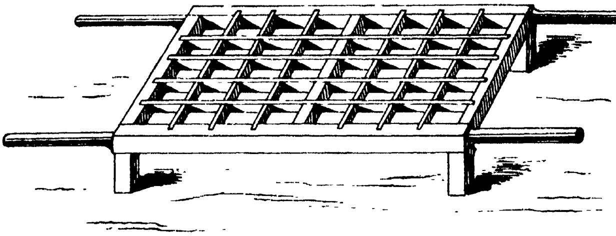


Fig. 13.

Yarn washing. Yarn in hanks is washed either by hand in vats or in so-called hank washing machines.

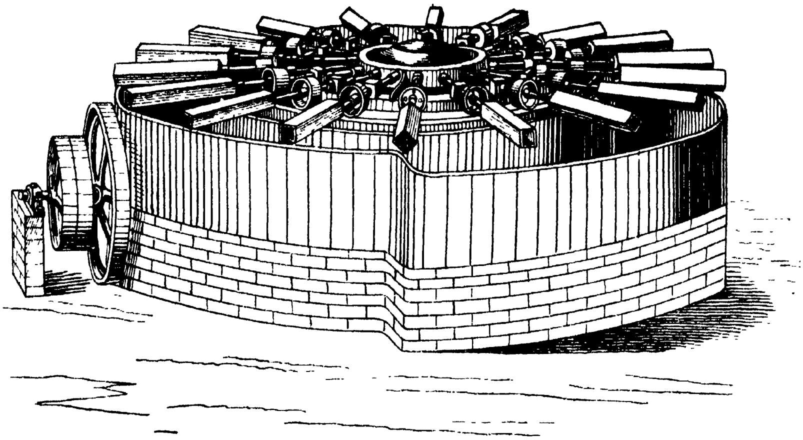


Fig. 14.

Circular Washing Machine. The sketch above (No. 14) shows a hank washing machine. There is a circular iron tank, above which a number of copper bobbins, connected with a centre piece, are fixed in such a way as to turn the bobbins when the machine is working round its own axle and at the same time to move to and fro a few times, then proceeding a few inches, turn again and so on. The tank has a watertight partition in the middle; this compels the water to circulate in the opposite direction to the yarn. One man places the hanks on the bobbins on one end of the partition, where the dirty water runs off and the other man takes out the clean hanks at the other end of the second partition, where the clean water runs in.

A different type of hank washing machine is one with a rectangular vat instead of a circular one. It consists of a moveable cross bar, mounted on a strong iron frame over an iron tank. The cross bar carries from 12 to 20 spools on which the hanks to be washed are suspended, and it receives a swinging motion whilst each spool is kept turning on its own axle by means of a friction chain, thus working the hanks in the wash liquor. During the operation a continuous flow of fresh water is passing through the tank.

There are still other hank washing machines of other designs, but the above described being the two kinds mostly used, we think it unnecessary to illustrate any more.

Hydro-extractors.

After the yarn comes from the washing machine, it is too wet to be dried right away. Therefore it is either wrung by hand on wringing posts, which is a rather slow process, or it is better "whizzed" in the hydroextractor. The main part of the hydroextractor is an iron or copper drum, mounted on a vertical axle, which is turned around very quickly either by a small steam engine or by a belt connected with the shaft The yarn is laid evenly into the drum, and when set working, the water is driven out by the centrifugal power. We give two sketches, one showing a hydroextractor coupled with a small steam engine, the other one to be driven by belt.

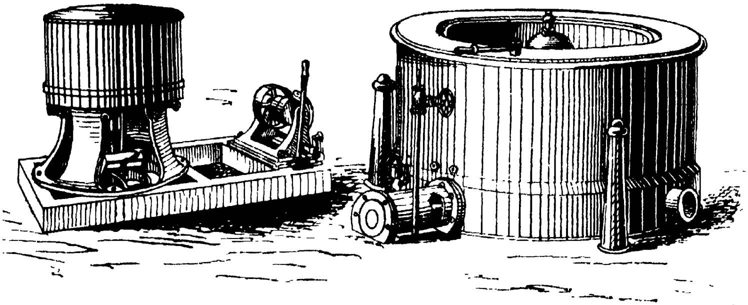


Fig. 15.

Drying room.

After the yarn has been wrung or whizzed, it may be dried in the open air. Under all circumstances, however, it is preferable to have a special drying chamber, in which the yarn not only dries much quicker but which permits the drying process to go on independent of the weather. Drying chambers are constructed in various ways, either pukkah-built, or of wood. For India we are in favour of a pukkah-built well ventilated room, supplied with a good number of steam heaters. The drying room must have an appropriate number of air holes at the bottom of the walls; close to the air holes are the steam heaters. On the roof of the drying room some sort of ventilation, a chimney, is put up, to allow the moist air to escape. For drying 1000 lbs. of yarn per day there should be a drying room of 15 by 15 feet, at the bottom of the walls 50 air holes of 3 inches diameter each, about 300 square feet of steam heater surface and a chimney of 2 feet diameter and 6 to 10 feet height. The yarn is hung up on sticks, which rest on crossbeams.

arn Drying Machine.

It is in many instances desirable, that the yarn should be dried very quickly and evenly. For such cases a yarn drying machine is indispensable. It consists of a large winch, with 8 to 16 arms. Some arrangement is made to stretch the yarn between the arms, as may be seen from the sketch. The machine makes about 60 revolutions in one minute and dries up to 1800 lbs. of yarn in 10 hours. It may be placed into the drying room or into an ordinary room without steam heaters.

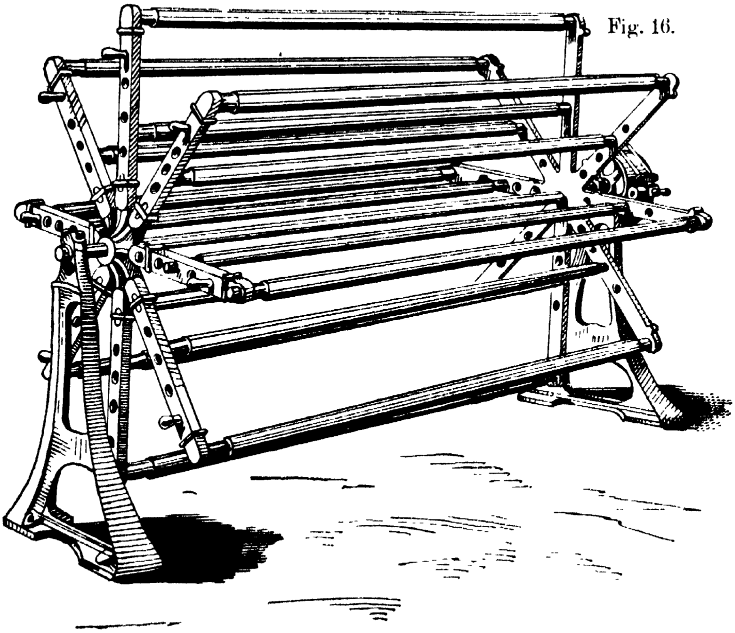


Fig. 16.

Fairly accurate scales and sets of weights are of great importance. We recommend to put up the scales together with the stock of dyes in a small separate room, where the dampness from the dyehouse cannot get in. **Scales.**

Besides, the colour-dust is always flying about in the store room which is also a reason for keeping this place separated from the dyehouse.

DIRECTOR OF INDUSTRIES. LIBRARY. JAN. 1923 BENGAL.

II. Outfit for Loose Cotton Dyeing.

For dyeing loose cotton for which purpose our Diamine and Immedial Colours are equally well adapted as for yarn dyeing, somewhat different arrangements must be made, as this material cannot be handled so easily as yarn.

Vats.

The dyeing of loose cotton can be carried out in ordinary wooden vats such as used for yarn dyeing. Frequently the cotton is put into a net and then placed into the vat so as to lift it again by means of a rope and pulley and to put it into another vat for aftertreatment, washing, etc. This method is illustrated by the following sketch.

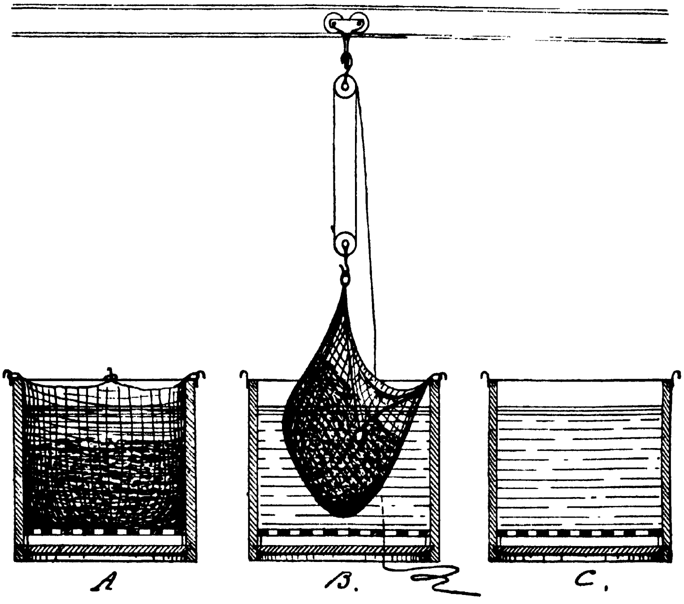
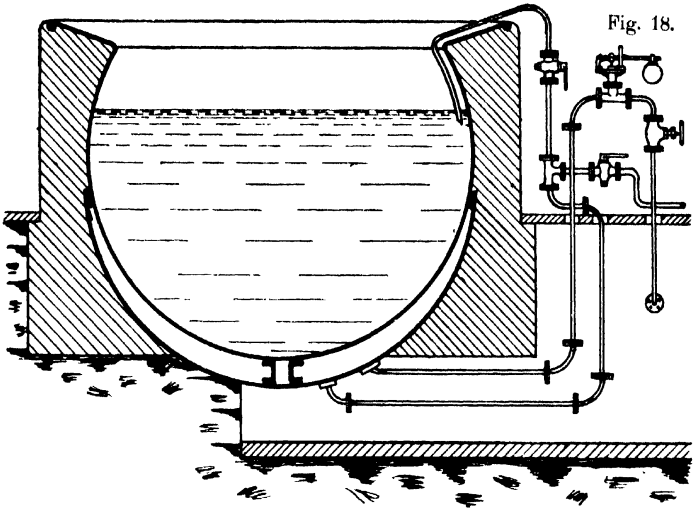


Fig. 17.

Jacketted pans.

Very convenient for dyeing loose cotton with Diamine Colours is a round boiler made of copper and provided with a steam jacket.

Fig. 18.



Immedial Vat.

The iron dye vat*) as per sketch 19 below which contains an inner kettle by means of which the cotton may be lifted out of the liquor is very useful for Immedial Colours, but may also serve for Diamine Colours.

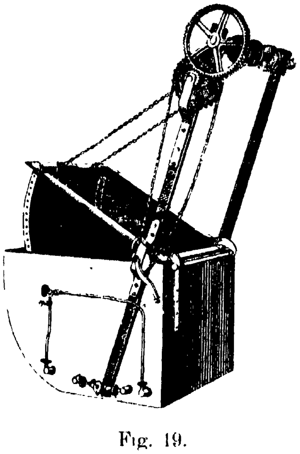


Fig. 19.

Dyeing machines.

Lately quite a number of different systems of dyeing machines have been introduced into dyehouses for loose cotton which give much satisfaction in working.

---

*) Built and sold by Ernst Gessner at Aue in Saxony.

A very convenient machine is the one of Obermaier. It consists of a perforated drum into which the cotton is pressed by means of a cover and screw. A centrifugal pump forces the dyeliquor into a perforated centre-piece and from there through the cotton. The advantage of this system is that the cotton does not get felted and stringy in the least, that the shade is perfectly even and that a comparatively small amount of dyeliquor is necessary, which means a considerable saving of drugs.

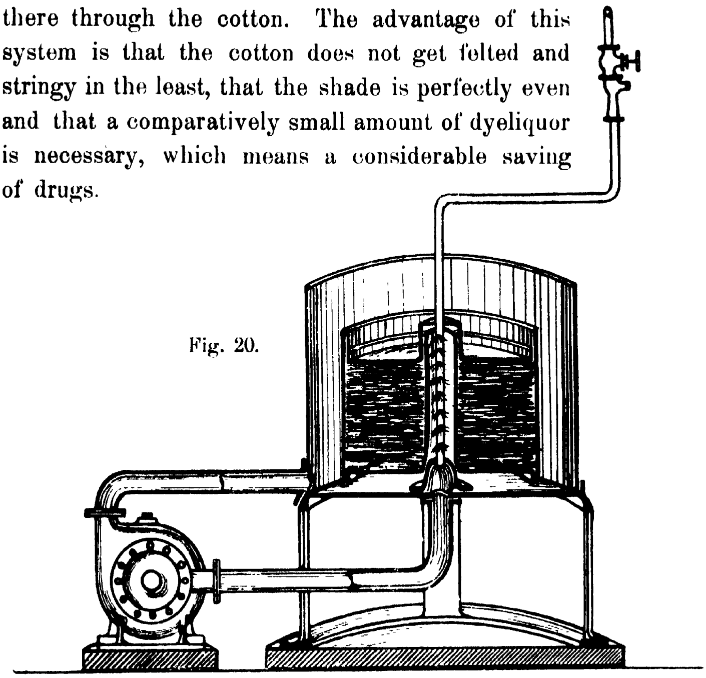


Fig. 20.

Washing machines. After dyeing, the cotton must be rinsed, for which purpose a washing machine is used We give a sketch of such a machine Fig. 21. It consists of a round tank with a centre piece, around which the cotton is kept moving by means of forks or sometimes also by a paddle wheel. There is a continuous supply of fresh water flowing into the tank. About 100 lbs. of cotton can be washed at a time.

Hydro-extractor. Exactly the same hydroextractor as described for yarn is used for whizzing loose cotton.

Drying. For loose cotton a special drying chamber is almost indispensable. It consists of an air-tight room with a wire netting through the whole length and breadth of it, about 3 to 4 feet above the bottom The cotton is distributed evenly on this wire netting. A ventilator is built into the wall which sucks the air through a steamheated box, where the air is heated, then

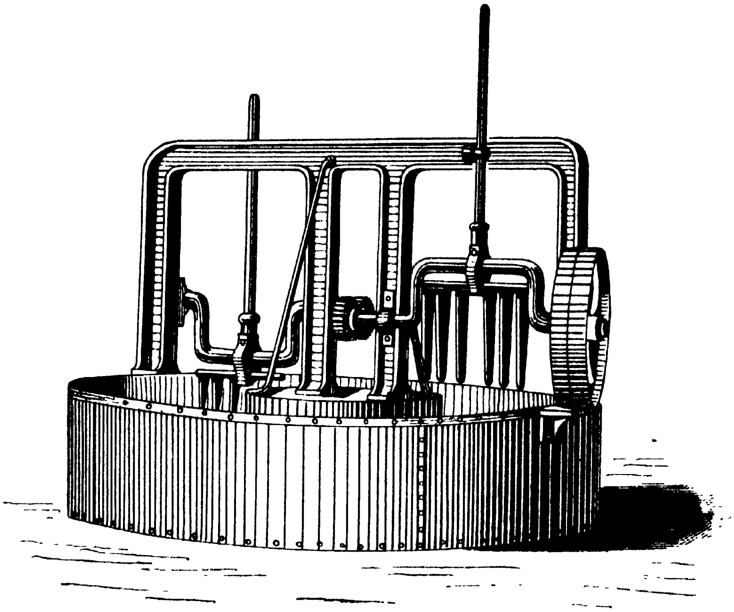


Fig. 21.

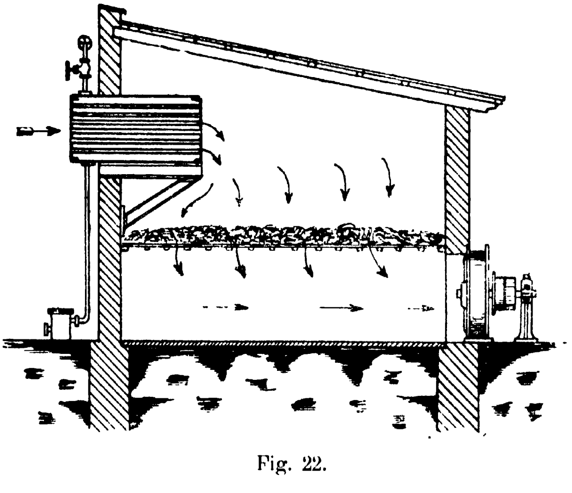


Fig. 22.

through the cotton and finally the air charged with moisture is removed by the ventilator. This system permits of drying large quantities of cotton in a short time.

III. Outfit for Piece Dyeing.

The many advantages possessed by our Diamine and Immedial Colours constitute one of the principal reasons for their vast and ever increasing employment in piece dyeing.

Diamine and Immedial Colours are used for dyeing ordinary kinds of light piece goods, linings etc. as well as for heavier fabrics such as moleskins, cloakings, cotton coatings, raised cotton cloth, beaverteens, velveteens etc.

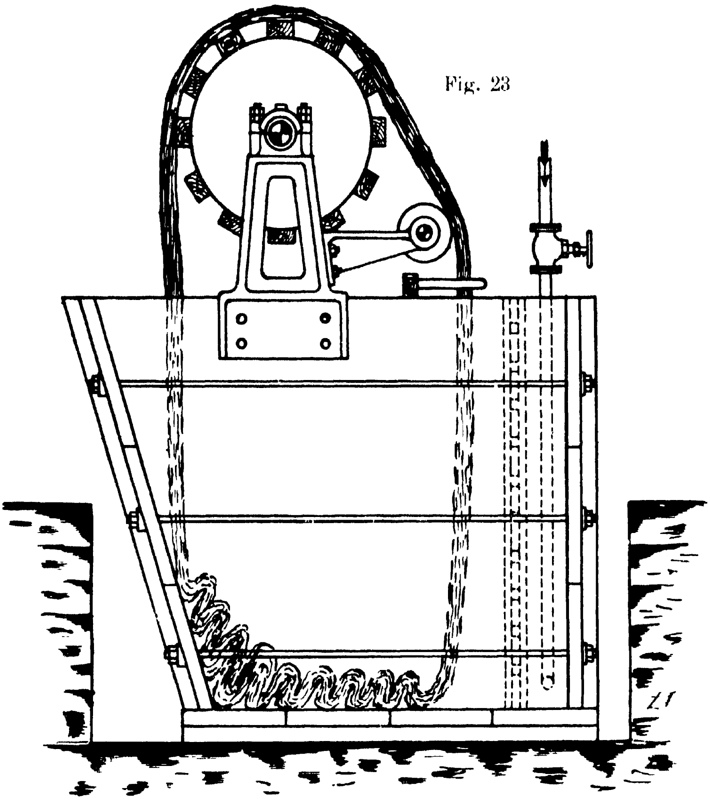


Fig. 23

Open vat. The open vat is the simplest arrangement for piece dyeing. It is an ordinary wooden vat, sometimes U shaped, above which a small and a large roll are placed. A number of pieces are sewn together end to end so that they run in form of an endless chain through the dyeliquor. The vat is of course supplied with a steam pipe as usual. (Fig. 23, page 22).

For dyeing Immedial Colours the open vat is not very well adapted. These are dyed in the jigger, padding machine or continuous machine which must not contain any parts of copper (p. 121).

Jigger.

When dyeing cloth in an open vat, a very large amount of dyeliquor and consequently large quantities of drugs are used. In order to overcome this difficulty, a special machine called "Jigger" has been constructed and is now largely in use in Europe as well as in India.

Fig. 24 a and b shows a Jigger in section. It consists of a wooden, sometimes cast iron dyevessel, which is rather narrow at the bottom. There are two rollers above the vat, which can be driven one at the time by a cogwheel and belt, connected with the main shaft. Besides there are cast iron arms arranged at both ends of these rollers, which act as bearings for the interchangeable roller. There are three small rollers arranged inside the vat, two of them being as near to the bottom as possible. The sketch shows the course which the pieces take around these rollers.

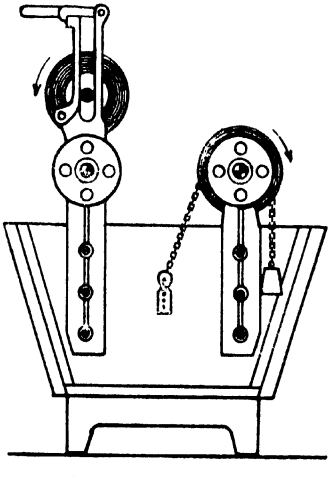


Fig. 24 a. Side-view.

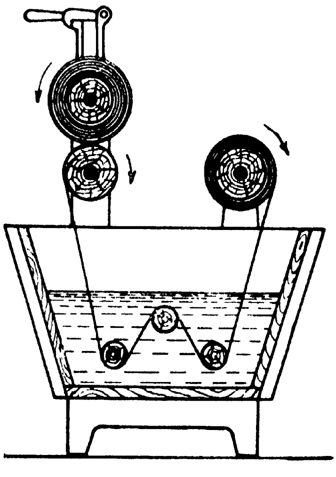


Fig. 24 b. Section.

The manipulation is very simple. The pieces run say 6 to 10 times from one roller through the dyeliquor on to the other roller. As the cloth passes through the jigger always stretched and without any wrinkle, it therefore must necessarily be dyed perfectly even. The quantity of dyeliquor filling only the lower part of the jigger is comparatively small and the working with such a machine therefore is very economical, especially when dark shades are produced. The upper roller serves for transporting the cloth to and from the jigger.

Immedial Jigger.

The jiggers are frequently provided with a pair of nippers as shown on the jigger for Immedial Colours sketch 25 (p. 25) such nippers allowing an even squeezing of the goods before leaving the dyebath and ensuring the production of level shades. The first jigger serves for dyeing and the other for rinsing.

Sketch 26 (on next page) shows a jigger of the same type with a series of guiding rollers to lead the cloth through the air for oxidising after dyeing with Immedial Indone before it runs into the second jigger for rinsing.

Padding machine.

The padding machine sketch 27 (p. 26), consists of two or three rollers which are pressed together by a lever arrangement. Underneath the rollers is a wooden or copper box for holding the dyeliquor. This machine which is mostly used for dyeing light and medium shades on thin fabrics is worked in the following way. The dyeliquor is filled into the box. The cloth passes over a roller, through the dyeliquor and is then squeezed off by the rollers. The advantage of the machine is, that the pieces intended for light shades are finished with one or two passages and are immediately afterwards ready for drying.

Continuous Dyeing Machine.

For a large production of staple colours, especially for black, dark blue and dark brown the continuous machine is used with advantage (sketch 28, (p. 26). This is a roller box divided in two, three or four compartments each of which is heated by indirect steam. Between each compartment and at the end of the last one squeezing rollers are placed and each compartment is fitted with a number of guiding rollers above and below. The dividingo bards are

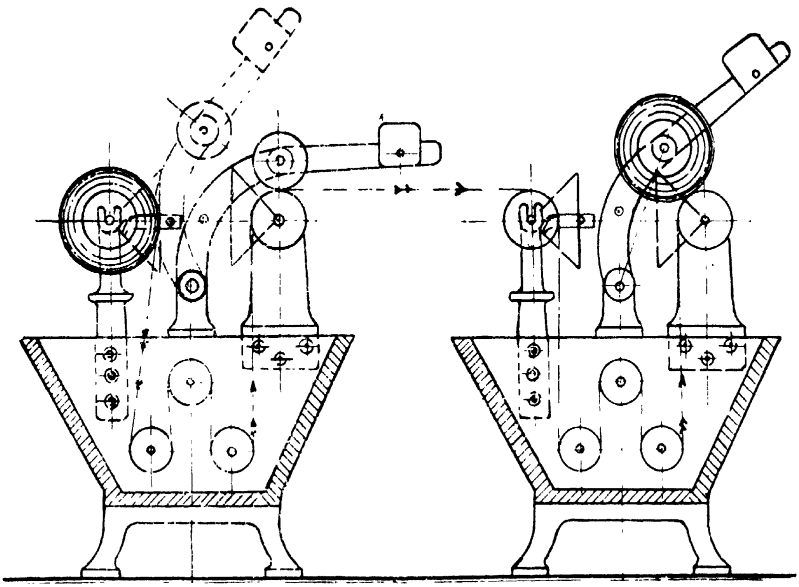


Fig. 25.
Double Jigger for Immedial Colours.

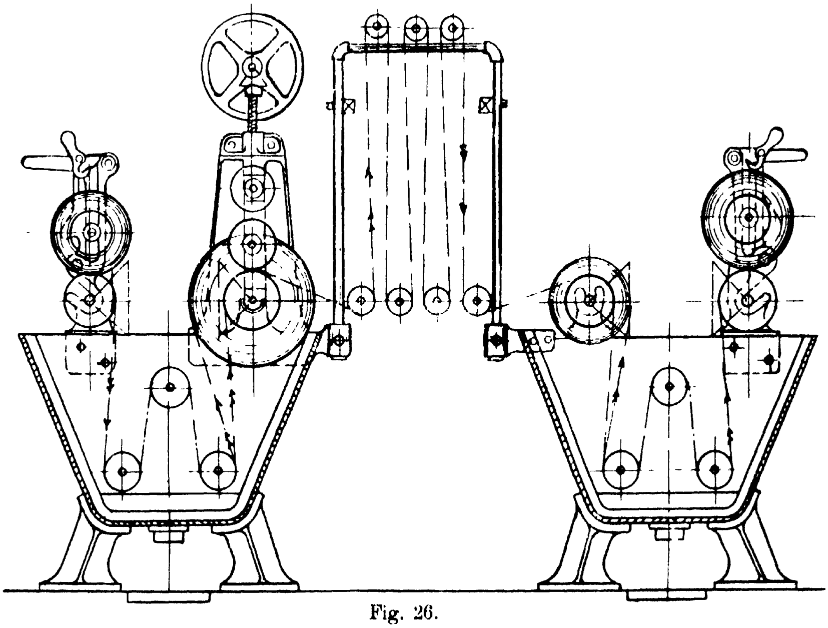


Fig. 26.
Double Jigger with Oxidising appliance for Immedial-Indone.

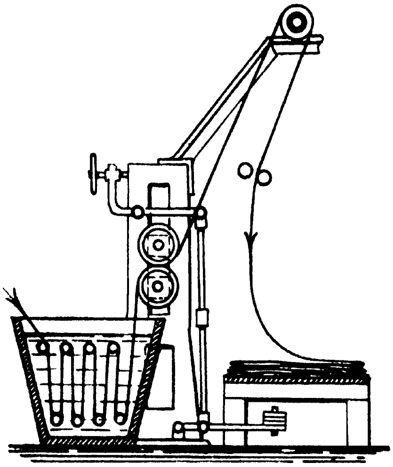


Fig. 27.

perforated in order to keep the liquor in the various compartments on the same level. The goods pass through the machine, the

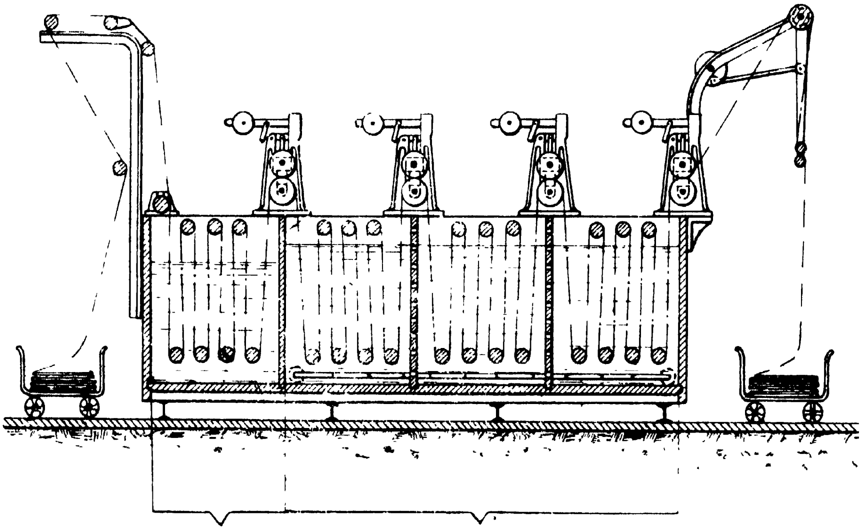


Fig. 28.

concentration of the dyeliqour being so regulated that the goods are dyed in one passage.

The following sketch 29 shows a continuous dyeing machine specially constructed for Immedial Colours, but also very well applicable for Diamine Colours.

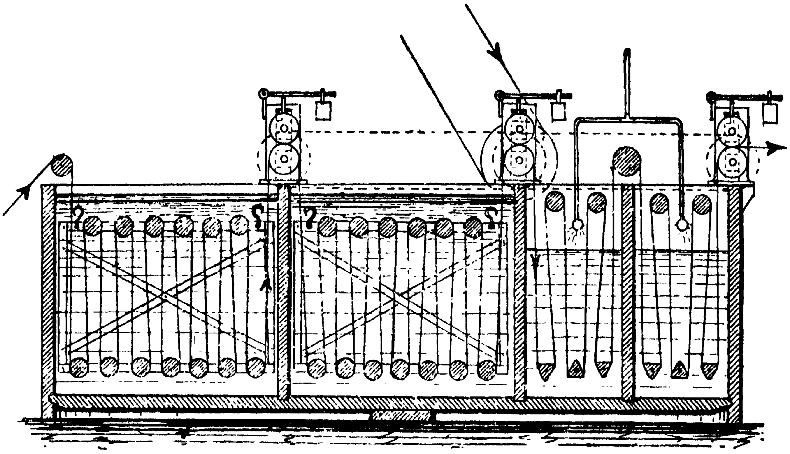


Fig. 29

I and II are boxes for dyeing, fitted up with a system of rollers which are entirely covered by the dye-liquor.

The board dividing the two boxes is perforated in order to keep the liquor in both at the same level. The roller bearings are fixed in an iron frame which may be lifted at will.

III and IV are the usual rinsing boxes.

The boxes may be made of either wood or iron, but the inside guiding rollers should always be of iron. The squeezing rollers may both be made of wood, or the lower one of wood and the top one of iron and, if required, coated with rubber; they are as usual covered with cloth. A closed iron steam coil serves for heating the bath.

Washing machines.

There are different kinds of washing machines. Where jiggers are employed a so-called "Roller washing machine" (sketch 30, page 28) should be used, as the pieces come out of the jigger in rolls and should remain in this form when entering the drying machine. this will only be possible by employing a roller washing machine, which consists of a vat with many rollers at the bottom and corresponding rollers at the top of it. The cloth passes over a top roller and under a bottom roller alternately and is thus passed many times through the water and finally through squeezing rollers, when it is ready for the drying machine.

Drying machines.

For drying pieces the ordinary Steam Drum Machine (sketch 31) is in general use. It consists of a number of tinned iron or copper cylinders, which are geared together by spur wheels so as to

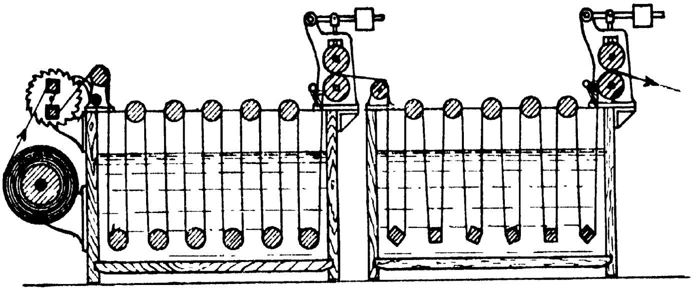


Fig. 30.

turn alternately in the same direction. These drums are heated by steam, and the pieces, in running over one drum after the other in a course which is distinctly shown in the sketch, are dried very quickly and independently of the weather.

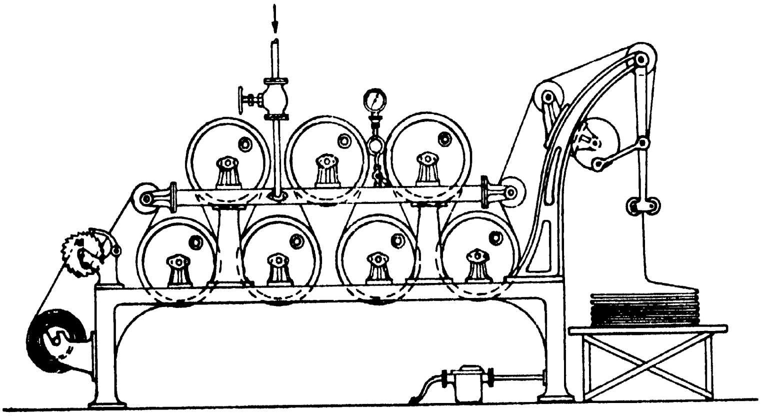


Fig. 31.

Steam Chest.

For special purposes a steam chest is required and for the sake of completeness we give a sketch below (sketch 32). The chest is fitted with an air injector so that it may be used for developing Immedial Blue by steaming.

We also refer to the wooden steam chest for developing Immedial Blue described in chapter VIII.

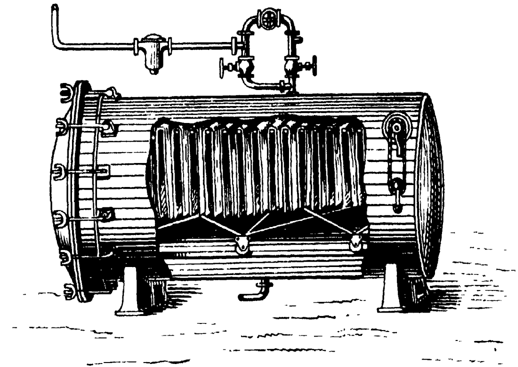


Fig. 32.

Arrangements for Dyeing Patterns.

Although the numerous shadecards give all possible information, the dyer will very often be obliged to vary the instructions, proportions etc. on account of difference in material, water etc. Especially if delicate shades are wanted, the only safe way will be to make a test on a small scale previous to dyeing a large lot. For this purpose a place where samples can by dyed and shades matched will be found most useful. A few small dyevessels and a pair of accurate scales and small weights are quite sufficient to carry out these tests.

Dyer.

The dyehouse must be under the control of a good and thoroughly trained dyeing master. The contents of the following pages will be convincing, that it is not so very easy to study and commit to memory the many methods and the constant new inventions, which to understand thoroughly is an absolute necessity for remunerative working.

Chapter II.

Preparation
of the
material previous to dyeing.

Cotton yarn as well as cloth, which comes from the spinning and weaving mill, is naturally quite dirty and filled with oily matter, stiffening a. s. o. These impurities must be thoroughly removed, as they are very troublesome in the dyeing process. This is done by two entirely different methods. The first method, mostly used for yarn, consists in boiling the yarn for some time in a fairly strong alkaline bath. The second method, exclusively used for cotton cloth, consists in removing the starch and dirt by a fermentation-process, called „souring“.

Boiling of yarn.

Cotton yarn is boiled in an open vat with 1 % to 5 % soda-ash (reckoned on the original weight of the dry yarn) for at least one hour. The yarn is generally made up in so-called chains by linking hank into hank. The chains are entered into the boiling soda bath and then covered with a board and stones to keep them well under the surface of the liquor. After one to two hour's boiling the yarn is taken out and immediately well rinsed in cold water, or better, cold water is run into the vat, until the soda-lye is washed away.

For Egyptian yarn a strong boil with fully 5 % soda-ash and subsequent washing is recommended.

Bleaching of yarn.

The boiling of cotton yarn with soda-ash only removes the fatty matters and the mechanically adhering dirt. If, for producing light and delicate shades, the material is to be perfectly white, it has to be bleached. In this country a mild bleaching, — the so called Half-Bleach — is sufficient in most cases and is done as follows.

Half-Bleach.

Dissolve 2½ lbs of soda ash in 2 gallons of hot water and let cool down. Mix in another basin 2½ lbs of bleaching powder (chloride of lime) into 3 gallons of tepid water, then add the soda solution, stir for about 10 to 15 minutes and allow the insoluble matter to settle. Then use the **clear solution only** for bleaching the yarn. This bleaching solution is just enough for 100 lbs of yarn.

The yarn is first boiled off with 2 to 3 % caustic soda, then washed in cold water. The bleaching solution is poured into a clean wooden vat — a special vat is generally reserved for this operation — and the necessary quantity of cold water is added. The yarn is entered and turned for 1 to 1½ hour, then lifted, allowed to drain and handled for about 15 minutes in a bath containing 2—4 % muriatic or sulphuric acid. Hereafter thoroughly washing is very important in order to remove every trace of chlorine and acid, otherwise the yarn may get rotten. We therefore recommend to add 1—2 % of hyposulphite of soda (Antichlor) to the hot washing water, which destroys any chlorine remaining in the yarn.

The two first patterns in the shadecard show the effect of this process. Whereever „bleached“ yarn has been used in this shadecard, it has been bleached strictly according to the above recipe.

Boiling of cloth.

The cleaning of cotton pieces requires much more care than that of yarn on account of the fact that the size, used for strengthening the warps, and the accidental impurities by which the pieces are almost invariably soiled, such as grease from the machinery, finger marks, iron spots etc., must be removed This is partly attained by washing with water or "bowking“ with alkalies and soap and completed by a treatment with diluted acids, followed by thorough washing with water.

rey washing.

The so-called **"grey washing“** which precedes the boiling, consists in passing the pieces, which are stitched together end to end in rope form, through a washing machine filled with water only and then allowing them to lie in a heap over-night. By this treatment all the impurities which are soluble in water are removed; the material becomes thoroughly wetted and the starchy matter becomes soluble in consequence of a fermentation which sets in and which causes a considerable rise of temperature in the goods. This process requires some attention as the fibre will suffer, if the fermentation should become too vehement and the temperature rise to high.

Following the grey washing the pieces are boiled off or bowked in open tubs or in closed iron kiers under pressure.

The open tub is usually made of wood. For a daily production of about 1500 lbs of cloth it should have a diameter of $5^1/_2'$ and a height of 8′. It is provided with a false perforated bottom, in the centre of which an iron or wooden pipe for the circulation of the liquor is erected. This is effected by fixing a steam injector into the lower end of this centre pipe. The steam forces the liquor up the centre pipe and showers it over the goods. It then trickles through the cotton pieces and collects again under the false bottom, to be ready for a new circulation. The pieces must be packed tight and evenly into the tub. It is of importance that no open channels are left through which the liquor could escape and cause irregular circulation, otherwise the effect of working would be very unsatisfactory. For the same reason the pieces are covered with cloth and kept from rising by wedging two heavy cross-beams on top of them.

After the pieces are packed into the tub, a soda solution, containing 2 to 5 % soda-ash (reckoned on the original weight of the pieces) is run in. The quantity of water must be large enough to entirely cover the pieces during the boiling in order to keep off the air, which has a very detrimental effect on cotton saturated with hot alkali lye. Steam is then blown into the injector which causes the liquor to circulate and at the same time to boil. This is continued for 6 to 12 hours. The liquor is then run away and the goods rinsed and cooled down with water. A more complete removal of the soda and impurities is now necessary and this is done by running the pieces through a washing machine.

Grey souring

This consists in wetting the pieces with weak cold sulphuric acid of 1° to 2° Twaddle in a washing machine, then allowing them to lie in a heap over night. Fermentation sets in very quickly and makes soluble the starchy matter contained in the piece. The same precautions should be observed as described with the grey washing. After the grey souring the pieces are taken through the washing machine and the acid is thoroughly removed with plenty of water. After this treatment the pieces are ready for dyeing.

Bleaching o Cotton cloth

Cotton cloth is bleached in a similar way as yarn, only a special arrangement is made for the pieces to run direct from the bleaching tank to the acid tank and washing machine. This is a little more complicated and requires an experienced bleaching master. We therefore refrain from going more thoroughly into this matter.

DIRECTOR OF INDUSTRIES.
LIBRARY.
JAN. 1923
BENGAL.

Chapter III.

Application
of the
Diamine Colours for Cotton Dyeing.

Method of Dissolving the Dyestuffs.

The Diamine Colours are best dissolved in boiling water, which should be either condensed water or otherwise free from lime.

Calcareous Water.

If calcareous water alone is at command, it is advisable to dissolve in it some carbonate of soda, equal in weight to the dyestuff employed, the dyestuff being only added after the solution has been brought to the boil.

As a rule the dyestuff dissolves quickly on stirring. The solution is best strained into the dye-bath through some cotton cloth, or through a fine sieve. Any undissolved particles of dyestuff perchance remaining on the sieve, may be brought into solution by pouring boiling water over them, or by boiling them up again with fresh water.

To save the separate operation of dissolving, the dyestuffs are often put directly into the dye-vessel. In this case it must not be forgotten to add to the dye-bath first a little carbonate of soda, then the dyestuff, and, after boiling up well, the salt necessary to ensure a good result in dyeing.

We always recommend, however, the *separate* dissolving of the colour, although in the case of dyeing shades which are neither delicate nor otherwise sensitive, it is quite permissible to add the colouring matter directly to the dye-bath.

General Remarks on the Dyeing of Cotton with Diamine Colours.

Diamine Colours are dyed at the boil with the addition of neutral salts, e. g. Glauber's salt, or Common salt, with or without the further addition of such alkaline substances as soap or soda.

Effect of neutral salts.

The neutral salts accelerate the absorption of the colouring matter by the fibre. The more salt the bath contains, the quicker the absorption takes place, even so, that undue excess of salt tends to precipitate the dyestuff and to produce uneven shades.

Effect of alkaline salts.

Soda and soap have the opposite effect, help the colour to be better soluble and protract the absorption, thus favouring even dyeings

Wherever in the following pages Glauber's salt or soda are mentioned, the *desiccated* products are referred to, and these bear the following relations to the corresponding crystallised salts:

100 parts desiccated Glauber's salt are equal to
220 parts crystallised Glauber's.
100 „ „ soda (soda-ash) are equal to
270 parts soda crystals.

The degree of purity of the salts is, as a rule, of secondary importance. Common salt, Glauber's salt, and ordinary crushed Rock salt or Fish salt, may be unreservedly used, except when dyeing very delicate pale shades, in which case, of course, the pure materials should be employed, namely, crystallised Glauber's instead of the desiccated salt, and common salt instead of Rock salt.

Quantity of water.

It is of importance that the quantity of water be in proper proportion to the quantity of material. The more water in the bath, the more difficult it is to exhaust the colour, wheras the more concentrated the solution, the more easily does the absorption of the colouring matter take place. Practical working shows that a concentrated bath not only exhausts better but also that deeper and fuller shades are obtained if the quantity of water is not unnecessary large.

In dyeing yarn, generally 20—25 times as much water is used, as the yarn weighs, namely for 10 lbs. of yarn 200—250 lbs. water, i. e. 20—25 gallons, whilst for dyeing 10 lbs. of loose cotton 18—20 gallons are quite sufficient. In piece dyeing the proportion is more favorable still, if special dyeing machines like the "Jigger" or "Padding machine" is used, which permits to reduce the quantity of dyeliquor to a minimum.

Indirect steam.

In order to keep the bath concentrated, it is advisable to heat the dyevessel with "indirect" or "closed" steam and *not* by blowing steam direct into the dyeliquor, since the latter, on condensing would *increase* the quantity of water, whilst indirect steam has the desired opposite effect.

The Salts used in dyeing.

Three methods are in use when dyeing with Diamine Colours, differing from each other, however, only in respect to the ingredients added to the dye-bath

1. Dyeing with Soda and Glauber's Salt, or with Soda and Common Salt.

This method may be regarded as the most usual one, being employed with the majority of the dyestuffs and for almost all shades.

Medium and dark shades require the addition to the dye-bath of 2 % soda and 20 % Glauber's salt or common salt, whereas half these quantities will be sufficient for lighter shades, or even one-fourth the quantity for very delicate tints, unless, the third method given below is adopted in which soap is used.

If it is a question of retarding the absorption of the colouring matter, as for example, in the case of pale shades, or with materials which are difficult to dye *through*, then we recommend to dye first for half an hour with no other addition than soda, then only adding the Glauber's salt.

2. Dyeing with Glauber's Salt, or with Common Salt, only.

For dark shades use 20—30 %, for light shades 10—15 %. This method is principally used with dyestuffs which exhaust slowly, also for the production of deep shades, in order to ensure as complete an exhaustion of the bath as possible.

Here, too, calcareous water must be corrected with a little soda, adding as much as will precipitate the lime present. Add, first, $^1/_4 - ^1/_2$ % soda (reckoned on the weight of the goods), then the dissolved colour, and, after boiling up, add the salt.

3. – Dyeing with Soap and Common Salt, or with Soap and Glauber's Salt.

This method should be employed in all cases where slow dyeing is necessary, especially in the production of delicate tints or compound shades which are not easily matched, or with materials which cannot be properly dyed *through* in any other way. Calcareous water must be corrected by the addition of ½ % soda reckoned on the weight of the goods, before soap is added. The soap is replaced with advantage by Turkey-red oil or Universal oil which are less sensitive to calcareous water.

Take for

very light tints	2 %	soap and	2 %	common salt*)
medium shades	3 %	„ „	5 %	„ „
dark shades	5 %	„ „	15 %	„ „

Commence dyeing at a low temperature with the addition of soap and dyestuff only, and add the salt after working a quarter of an hour.

Temperature. For light shades, enter the goods cold and raise the temperature of the dye-bath gradually, whilst for medium and dark shades the goods can be at once entered warm. In most cases several lots of material may be dyed one after the other in the same bath, which is kept boiling continuously, each lot being boiled for one hour.

In some cases, especially for deep shades, it is advisable to dye the goods by boiling for half an hour only, then to shut off the steam, and finish them in the gradually cooling bath within ½ - 1 hour; in this way the dyestuff is utilised to the fullest extent. This method is adopted whenever it is desired to add to the depth of shade, or when the bath is not to be preserved.

If boiling is not desirable, a lower temperature of the dye-bath is admissible, say 160 175° F. (70 80° C.).

---

*) In dyeing very light shades, complete exhaustion of the colour is less important than perfect eveness of shade; therefore a much longer bath will be found of advantage, for 10 lbs. of yarn say 30 or even up to 40 gallons of water.

Exhaustion of the dye-bath.

With regard to the exhaustion of the dye-bath, the Diamine Colours present considerable differences. Some exhaust almost completely even when dyeing deep shades, whilst others do not. Whenever complete exhaustion does not take place, the baths may be kept for dyeing subsequent lots of material, being replenished with proportionately less colouring matter.

When dyeing in concentrated or short dye-baths i. e. with a small proportion of water, the exhausted liquors seldom contain more than a quarter of the dyestuff they contained originally, in many cases even less.

In continuous dyeing, the supplementary additions of soda and Glauber's salt, or other salts employed, should be about one third to one half of the original quantities used.

The exhaustion of the baths can be facilitated:

(1) By increasing the quantity of salt used. This is best effected by dyeing in the manner already indicated, and adding a further portion of salt towards the end of the operation. In such cases the goods must be rinsed with water soon after lifting from the dye-bath, otherwise the salt, which crystallises on the surface of the material when drying, is not easily removed.

(2) By working with *closed* steam.

(3) By allowing the goods to remain in the dye-bath after boiling, so that "feeding" of the dyed material with additional colour occurs in the cooling liquor.

Dyeing in consecutive lots.

When dyeing cotton with Diamine Colours, the latter are taken up by the material only partially and according to the concentration of bath, depth of shade, quantity of Glauber's salt or common salt, $^1/_{10}$ up to $^1/_3$ of the colour remains in the bath. It would be waste of material to throw away these dye-liquors, which, when dark shades have been dyed, naturally contain a fair amount of colour and salt. In order to make full use of dyestuff and mordant, new lots of material are dyed one after the other in this old bath with correspondingly less colour and mordant. This is called: Dyeing in an **old bath** or in **consecutive lots.**

If for instance 1000 lbs. of yarn were to be dyed black and such a shade be found to be obtainable with $7^1/_2$ % Oxy Diamine Black A in the first bath, we would dye 5 consecutive lots of 200 lbs. each in the following way:

1st lot	New bath:		$7^1/_2$ %	colour	600	galls.	water	80	lbs.	Glauber's	salt
2nd „	old bath from	1st lot:	$6^3/_4$ %	„	600	„	„	25	„	„	„
3rd „	„ „ „	2nd „	6 %	„	600	„	„	15	„	„	„
4th „	„ „ „	3rd „	6 %	„	600	„	„	15	„	„	„
5th „	„ „ „	4th „	6 %	„	600	„	„	15	„	„	„

After the second or third lot has been dyed in the old liquor the bath gets "settled", which means that the additions of colour and mordant necessary for further dyeings remain nearly constant.

The advantage of dyeing in consecutive lots is quite plain: the cost of the dyeing is reduced very materially. Besides an old bath produces more even shades than a new bath.

Indirect steam necessary.

To get the full advantage of dyeing in consecutive lots, the vats should be fitted with **indirect** steam pipes, otherwise the quantity of water would get larger and larger and the advantage of the old bath would be counteracted to a great extent by the disadvantage of getting a more and more diluted dye-bath.

Twaddling the dye-bath.

If an old bath is used many times over, the quantities of mordant may get too large, thus precipitating the colour and producing uneven dyeings. To prevent this, we recommend to control the dyeliquor from time to time by ascertaining its specific gravity with a Twaddle hydrometer. For this purpose some of the dyeliquor is filled into a high and narrow cylinder and after cooling down measured with the hydrometer.

For dark shades the bath should not measure more than 6° Tw. and for medium shades not more than $2^1/_2$° Tw. If the specific gravity has reached this number no further addition of mordant is necessary for the next few lots.

The Fixing of Diamine Colours by Aftertreatments with Metallic Salts.

Certain Diamine Colours may be fixed by a subsequent treatment of the dyed fibre with metallic salts, whereby the fastness to light and washing is in many cases greatly improved and the bleeding into white goods is diminished, if not entirely prevented.

Amongst the metallic salts suitable for this purpose, **sulphate of copper, chromium fluoride** and **bichromate of potash** or **soda** the so-called "bichrome" rank in the first place.

The dyestuffs in the following table may be aftertreated as follows:

With sulphate of copper, or with a mixture of sulphate of copper and bichromate of potash	With bichromate of potash or bichromate of soda	With chromium fluoride or chrome alum
Diamine Sky Blue FF, FFS	Diamine Dark Blue B	Diamine Yellow N
Diamine Blue RW, 3R, AZ, C4B	Diamine Brown B, M, R, S	Diamine Fast Red F
Diamine Brilliant Blue G	Diamineral Brown G	Diamine Bronze G
Diamine New Blue R	Diamine Catechine, all brands	Diamine Green G
Diamineral Blue, all brands	Diamine Jet Black SS, Cr, RB, OO, OOOO	Diamine Brown B, M, R, S
Diamine Deep Blue R	Diamine Fast Black X	Diamine Catechine, all brands
Diamine Bengal Blue G, R		Diamine Dark Blue B
Oxy Diamine Blue, all brands		Diamineral Blue R
Diamineral Black B, 3B, 6B		Diamine Jet Black SS, Cr, RB, OO, OOOO
Diamine Dark Blue B		
Diamine Fast Black F		
Diamine Brown M, B, 3G		
Diamine Catechine, all brands		
Diamineral Brown G		
Oxy Diamine Brown 3GN		
Diamine Orange B		

For shading the dyeings to be aftertreated either with sulphate of copper or with a mixture of sulphate of copper and bichromate of potash, any of the following Diamine Colours may be used:

Diamine Fast Blue, all brands
Diaminogene extra
Diamine Brown S, R
Diamine Fast Brown G, R, GB
Diamine Fast Orange EG, ER
Diamine Orange G, D
Oxy Diamine Yellow GG, TZ
Thioflavine S
Diamine Fast Yellow A, B, FF
Diamine Yellow CP
Diamine Bordeaux S
Diamine Brilliant Bordeaux R

Any of the Diamine Colours may be used for shading dyeings to be aftertreated with bichromate of potash or chromium fluoride.

As yellowing agents for dyeings to be aftertreated,

Diamine Fast Yellow B, FF and A

are best suited.

The baths for the aftertreatment must remain perfectly clear and always show an acid reaction; it is thus always essential to add acetic acid, particularly for the purpose of neutralising any soda left in the dyed material.

Sulphate of Copper.

The *aftertreatment with sulphate of copper* consists in passing the dyed goods for a quarter to half an hour, at a temperature of 175° F. (80° C.), through a bath containing, according to the depth of shade required, 3% to 5% sulphate of copper and 2% to 4% acetic acid reckoned on the weight of the goods.

Piece-goods are aftertreated either on the jigger or on the padding-machine. The bath is charged with a quarter to half an ounce of sulphate of copper per gallon of water through which the goods are passed twice at a temperature of 175° F. (80° C.).

As some Diamine Colours are altered in shade by the aftertreatment with copper salt, it is necessary, in order to be sure of the ultimate result, to determine on a small scale what these alterations are, and to rectify the shade accordingly before the copper treatment. Dyed goods already treated with copper salt may, however, still be shaded; for this purpose they are well washed and re-dyed with a suitable Diamine Colour with addition of Glauber's salt. The presence of soda in the dye-bath is not required in this case; on the contrary, it is disadvantageous. It is of course unnecessary to treat a second time with sulphate of copper.

Special attention may be drawn to the fact, as proved by numerous experiments, that the Diamine Blues suited for this process, which have been treated with sulphate of copper, retain their excellent fastness to light, **even after washing and soaping.**

Chromium Fluoride.

The *aftertreatment with chromium fluoride* is effected by boiling the dyed goods for a quarter to half an a hour with 1% to 3% chromium fluoride and 2% to 3% acetic acid. Pieces are treated either on the jigger or on the padding machine, the bath containing one eighth to half an ounce chromium fluoride per gallon of water.

Bichromate.

The *aftertreatment with bichromate of potash or soda* consists in passing the dyed goods for 10 to 15 minutes through a boiling solution of 3% to 4% bichrome and 2% to 3% acetic acid. In the case of Diamine Dark Blue B the duration of the chroming can be extended to half an hour. Pieces are chromed on the jigger or padding-machine.

Copper-Chrome.

The *aftertreatment with bichrome and sulphate of copper* does not differ from that with bichrome alone. Equal quantities are taken of these two salts.

Other Salts.

Other salts besides those of chrome and copper, *e. g.* salts of iron and alumina, exert a fixing action in the case of some Diamine Colours, and generally speaking, the treatment with these salts increases the resistance of all dyeings to washing and particularly also to water, even if no chemical fixing or lake formation takes place.

The dyed cotton, after having been rinsed, is treated for 10—20 minutes in a lukewarm bath, containing about 2 lbs acetate of alumina of 4° Tw., or 4½—6 oz sulphate of alumina, or again 8 oz alum, per 10 gallons of water; it is then whizzed or squeezed off, and dried straight away.

Pyrolignite of iron may be used similarly.

Diazotising and Developing.*)

New shades by diazotising and developing.

Some of the Diamine dyes possess the property of giving new and very fast shades, whenever the goods after being dyed in the ordinary way, are subjected to a special treatment. This process which is carried out in 2 successive baths is called the diazotising and developing process. The new shades differ from the original-ones not only by their greater depth, but especially by their excellent fastness to washing, light, acids etc.

Diamine Colours for diazotising etc.

The following Diamine Colours are capable of being diazotised and developed on the fibre:

Primuline
Diamine Azo Scarlet A, B, 4B, 8B
Diamine Azo Bordeaux B
Diamine Brown M, S, V
Cotton Brown A, N
Diamine Cutch
Diaminogene Sky Blue N
Diaminogene Blue NA, NB, 3RN, 6RN
Diaminogene Dark Blue
Diamine Azo Blue R, 2R, 6B
Diamineral Blue CVB, 3RC
Diamine Blue 2B, 3B
Oxy Diamine Violet BF
Diamine Heliotrope B, G, O
Diamine Black BH, BHN, BHR, BO, RO, ROO
Diamine Blue Black E
Diamine Azo Black B, R
Diamine Beta Black B, BB BGH
Oxy Diaminogene ED, EF, EM, FFN, FFG, OB, OBB, OT, OT extra
Diaminogene B, BR, BW, CCL, extra.

Some of these dyestuffs, like Diamine Cutch, Diaminogene Blue, and Primuline are invariably employed by the diazotising process. Others are also used in direct dyeing.

Diamine Colours non-diazotisable.

Not only diazotisable dyes may be freely mixed to produce certain shades, but also such Diamine Colours which remain unaffected by the diazotising and developing process can be used for shading diazotisable dyes. Such non-diazotisable Diamine Colours retain, after having gone through this process along with diazotisable Diamine dyes, their original fastness and their original shade. The Diamine dyes most suitable are

---

*) In connection with these remarks a special shadecard "Diazotized and Coupled Dyeings on Indian Cotton Yarn" Volume B has been issued.

Thioflavine S
Diamine Fast Yellow, all brands
Diamine Orange B, G
Diamine Fast Orange EG, ER
Diamine Fast Brown G, R, GB
Diamine Fast Scarlet, all brands
Diamine Fast Red F
Diamine Bordeaux S
Diamine Violet N
Oxy Diamine Violet B, G, R
Diamine Fast Blue, all brands
Diamine Blue 3R
Diamine New Blue R
Diamineral Blue R, B, 3B
Diamine Steel Blue L
Diamine Green B, G
Diamine Dark Green N
Diamineral Brown G
Diamine Black HW
Diamine Fast Black F

Process of Diazotising and Developing.

General Remarks.

(1) Dye with any of the colours capable of being diazotised, in the manner already known, and rinse in cold water (whizzing or wringing after rinsing is hardly necessary).

(2) Diazotise from 10—15 minutes in cold water containing nitrite of soda and hydrochloric or sulphuric acid, then rinse in water containing a little hydrochloric or sulphuric acid.

(3) Develop from 10—15 minutes in cold water containing one or the other of the developers mentioned hereafter.

Nitrite Bath.

The diazotising and developing always takes place in a **cold** bath in **wooden** vessels.

For 100 lbs. cotton take for the first bath
3 „ nitrite of soda
9 „ hydrochloric acid, 32° Tw.

or instead of hydrochloric acid use 5 lbs. sulphuric acid, 168° Tw. For pale shades $^{1}/_{2}$ to $^{2}/_{3}$ of these quantities are sufficient.

First dissolve the nitrite in some cold water and add the solution to the bath, then add the sulphuric or hydrochloric acid.

It is not necessary to whizz or wring off after diazotising. Allow the goods to drain, then rinse them slightly in water, acidulated with asmall quantity of hydrochloric or sulphuric acid and enter **immediately** into the developing bath.

It is important not to let the goods lie at all in the intermediate stage after the diazotising, but to proceed at once with the rinsing and developing. Special care must be taken, that the goods, whilst in the diazotising bath, be not exposed to direct sunlight. The diazotising and developing operations are always conducted in **cold** baths.

Developers. The shades of the colours obtained differ according to the developer chosen, as shown by the shades in the card. The chemicals which have been hitherto introduced as developers are:

Beta-Naphtol
Diamine (Phenylene Diamine)
Resorcine
and others which may be pointed out on application

The developers are best dissolved in pretty large quantities and kept ready for use in stoppered earthen jars something like sulphuric acid jars. The solutions are prepared as follows:

Beta-Naphtol. Mix in a perfectly clean wooden vessel, 20 lbs. Beta-Naphtol with 30 lbs. soda lye 75° Tw. When well mixed pour over it 20 gallons fully boiling clean water and stir continually until a clear solution results. For developing 100 lbs. of original grey yarn, which are dyed to a **dark** shade use 10 % = 1 gallon or 10 lbs. of this Beta-Naphtol-solution. On the other hand for developing 100 lbs. original grey yarn, which are dyed to a **medium** or **pretty light** shade use 5 % = ½ gallon or 5 lbs. of this Beta-Naphtol-solution. For extremely light shades a still smaller quantity may be taken

Diamine 93 % in Powder or Diamine C S. Put into a clean wooden vessel 9 lbs. Diamine 93 % in powder or Diamine C S and 3 lbs soda ash. Pour over the mixture while continually stirring 20 gallons **fully** boiling water. It is advisable to boil the solution for about 5–10 minutes. For developing 100 lbs. of original grey yarn, which are dyed to a **dark** shade, use 15% = 1½ gallon or 15 lbs. of this Diamine-solution. On the other hand for developing 100 lbs. of original grey yarn, which are dyed to a **medium** or **pretty light** shade use 7½% = ¾ gallon or 7½ lbs. of this Diamine-solution. For extremely light shades a still smaller quantity may be taken.

Resorcine. Mix 11 lbs. Resorcine with 24 lbs. soda lye 75° Tw. Pour over this while continually stirring 20 gallons hot water. Stir till the solution is clear. For developing 100 lbs. of original grey yarn, which are dyed to a **dark** shade use 12½% = 1¼ gallon or 12½ lbs. of this Resorcin-solution. On the other hand for developing 100 lbs. of original grey yarn, dyed to a **medium** or **pretty light** shade, use 6¼% = ⅝ gallon or 6¼ lbs. of this Resorcine-solution.

NB. It is important that the developing bath prepared with Beta-Naphtol, Diamine or Resorcine always be distinctly alkaline, and the proportions of soda in the developer solutions have been calculated sufficiently large to make a special addition of soda to the developing bath unnecessary.

Mixing of Developers for Shading Purposes.

All the above mentioned developers can be freely mixed, for instance:

Beta-Naphtol and Resorcine
Beta-Naphtol and Diamine
Diamine and Resorcine.

We sometimes mention "Diazotise and develop with half Resorcine and half Beta-Naphtol", which for **dark** shades on 100 lbs. of yarn means to charge the developing bath with 5% or ½ gallon or 5 lbs. Beta-Naphtol-solution and 6¼% or ⅝ gallon or 6¼ lbs. Resorcine-solution. If we say: "Diazotised and Developed with three-fourths Beta-Naphtol and one-fourth Diamine" we mean that the developing bath must be charged for **dark** shades on 100 lbs. of yarn with about 9% or 9/10 gallon or 9 lbs. Beta-Naphtol-solution and 3¾% or 3/8 gallon or 3¾ lbs. Diamine 93% solution.

Along with the various shades of this card we have given the exact quantities of developers used.

The shades obtained by developing with *such mixtures* stand between those obtained with the respective single developers. For instance Diamine Black BO developed with Beta-Naphtol gives a blackblue shade — developed with Diamine a deep black perhaps slightly brownish shade —; developed with Resorcine a greenish black. Now if developed with:

Half Beta-Naphtol and half Diamine the shade obtained will be of a fine black with a blue cast.

Half Beta-Naphtol and half Resorcine, the shade obtained will be of a fine black, yet slightly blueish.

Half Diamine and half Resorcine the shade obtained will be a beautiful full black inclining to green.

Practical Diazotising and Developing.

We will now explain the practical execution of diazotising and developing. Suppose 800 lbs. of yarn have to be dyed to a very fast black both as regards light and washing, we would dye the 800 lbs. consecutively in lots of 100 lbs. each with Diaminogene extra on one day and allow the slightly hydroextracted yarn to lie over night on the yarn rests. On the following morning we would diazotise and develop the dyed yarn again consecutively in 8 lots of 100 lbs. each. For this purpose four vats would be arranged in the following order:

Vat A to contain only cold fresh water and to serve for wetting the dyed yarn before diazotising by giving it a few turns.

Vat B to contain the diazotising bath. This would be charged for the first lot of 100 lbs. of yarn (dry weight) with cold water, then 3 % = 3 lbs. nitrite of soda previously dissolved in cold water; and subsequently 5 % = 5 lbs. sulphuric acid previously diluted with cold water are added. The vat is then filled with cold water to about two thirds of its height and the contents stirred with a rack.

Vat C to contain the intermediate washing bath, which for the first lot of yarn might be slightly acidulated with a few drops of hydrochloric or sulphuric acid. This however is not absolutely necessary. While vats A, B and D are ordinary vats of the usual 100 lbs. size, vat C is just large enough to allow 1 stick full of yarn to be immersed and conveniently turned. It is best to make vat C 3 feet long, 2 feet 6 inches wide and 2 feet deep. Vat C must be fitted with a continuous flow of water. A pretty wide water pipe must fill the vat without cessation and a somewhat narrower discharge-pipe must be kept open throughout the operation.

Vat D to contain the developing bath. This for the first lot of 100 lbs. of original grey yarn is to be charged with cold water then 15 % = 1½ gallon 15 lbs. Diamine-solution are added and the vat filled to two thirds of its height with cold water, stirring well

Thus the four vats would be ready for the first lot. Enter now the first lot — already on the yarn sticks — in vat A, give 3 6 turns; heap up on side and then enter a few sticks-full at a time into vat B, where two workmen receive and at once begin to turn them The whole 100 lbs. entered, turn for 30 minutes. Now station 2 men at vat C. Each stickfull is lifted separately from vat B and allowed to drain for a few seconds. Then is it handed to two men near vat C, who give each stickfull one quick yet thorough turn in vat C then lift it, allow the water to run off for a few seconds and at once hand it to two other workmen. who are stationed near vat D. These last two workmen at once begin to turn the yarn in vat D. When all the yarn is in vat D, continue to turn for 30 minutes, then lift, and put on yarn rests.

For the second and each following lot of 100 lbs. of yarn add to

Vat A cold water only.

Vat B 1 % = 1 lb. nitrite of soda and 2 % = 2 lbs. sulphuric acid and cold water if necessary.

Vat C a few drops of hydrochloric or sulphuric acid, filling the vat with fresh water constantly.

Vat D 12½ % = 1¼ gall. = 12½ lbs. Diamine-solution and cold water as much as necessary.

Work each lot as aforesaid. The work is very easy and if practised a few times is done with great regularity and precision.

This working order remains the same with Resorcine.

The order also remains the same for Beta-Naphtol. For the second and each following lot of 100 lbs. of yarn, however only 7½ % or ¾ gall. or 7½ lbs. Beta-Naphtol in solution need be added.

From above follows that when

1) Diazotising in consecutive lots only two thirds of the original quantities of nitrite of soda and sulphuric acid used for the first lot, need be a added to the old bath for the second and each following lot.

2) Developing in consecutive lots only three fourths of the original quantity of Beta-Naphtol, Diamine or Resorcine, in solution used for the first lot, need be added to the old bath for the second and each following lot.

Schaeffer Salt.

Another developer, for the most part, however, only of importance for the development of Primuline, is the so-called **Schaeffer salt** (sodium salt of Beta-Naphtolsulphonic acid). The same yields a brighter red with Primuline than Beta-Naphtol.

Dissolve

5 lbs	Schaeffer salt
3 „	soda ash, in
4 galls.	boiling water.

For developing use about the same quantity of Schaeffer salt as of Beta-Naphtol.

Soda Passage.

In addition to the usual method of producing Azo Colours on the Fibre by the aid of developers, there is another way of fixing the diazotised dyes, applicable in the case of certain Diamine Colours, in which the developing is replaced by a **simple treatment in soda solution.** The method is as follows: After diazotising in the usual manner, the goods, without washing, are entered at once into a solution of soda, containing 2 % to 5 % of soda-ash reckoned on the weight of the goods and being worked at a temperature of 105 to 120 F. (40° to 50° C.). After working the goods in this bath for half an hour, wash or soap as usual.

Topping Developed Shades.

Developed shades have the same strong affinity for basic dyes as the direct dyed Diamine colours and very beautiful and fast shades can be produced by this method.

Topping with Naphtindone.

The topping is simply done in a cold or lukewarm bath with the addition of 1/2 to 1 % alum and 1 to 2 % acetic acid. Only when topping with Naphtindone a hot bath 175—195° F. (80 to 90° C.) must be used.

DIRECTOR OF INDUSTRIES
LIBRARY.
JAN. 1923
BENGAL.

Method of Coupling Diamine Colours.*)

Coupling.

General Remarks.

For completely fixing the Diamine Colours on the fibre, we have also discovered a third method, which is applicable to a great many of the Diamine Colours and gives results of great technical value. It consists in coupling the dyed dyestuff with diazo compounds and we therefore call it the "Coupling Process". Its application is extremely simple, the dyed goods being merely passed through a bath containing the diazo-compound in solution. A large number of diazo-compounds may be used for this purpose; our experiments however have shown **Diazotised Paranitraniline** to be the most suitable and to yield the best results. Dyed goods thus treated yield shades of excellent fastness to washing.

The preparation of this diazo-solution is well known in most dyehouses from the method for dyeing Paranitraniline Red.

The effects which are obtained by this coupling process are illustrated by the shades in shadecard Volume B.

Diamine Colours which can be coupled.

The following is the list of the Diamine Colours which we have found specially suitable for the coupling process.

Diamine Nitrazol Black B pat.
Oxy Diamine Black A, JW, JE I pat.
Diamine Black BO
Diamine Jet Black OO, SS, Cr, RB pat
Diamine Blue Black E
Diamine Blue NC
Diamineral Blue CVB, 3 RC
Diamine Bengal Blue G
Diaminogene extra
Diamine Nitrazol Gren G pat.
Diamine Nitrazol Brown G, B, T, BD, RD
Diamine Brown S, V, MR
Cotton Brown A, N
Oxy Diamine Brown G, RN
Oxy Diamine Orange R, G
Diamine Orange D
Diamine Fast Yellow A
Primuline
Diamine Grey G pat.
Diamine Bronze G.

---

*) In Connection with these remarks a special shadecard "Diazotised and Coupled Dyeings on Indian Cotton Yarn" Volume B has been issued.

Instructions for dissolving Paranitraniline C

Diazotising Paranitraniline.

Dissolve
2 lbs. Paranitraniline C in
1½ gall. boiling condense water and
½ „ muriatic acid 32° Tw.

After a little stirring complete solution has taken place. Then add

20–30 lbs. ice which precipitates the muriate in the shape of a yellow paste. When quite cold add
1⅛ lb. nitrite of soda dissolved in
¾ gall. cold water with brisk stirring.

In 15–20 minutes a clear solution results which is then brought to 20 gallons with **cold** water. This is called the diazotised Paranitraniline. This diazo-solution will keep for a considerable time in wooden or earthen vessels, provided these are not exposed to heat or sunlight.

Charging of the coupling bath.

The Coupling Bath.

Charge the cold coupling bath
per 100 lbs. of cotton.

For the dyeing done with 1½–2 % dyestuff with:
3½ galls. diazotised Paranitraniline C
½ lb. dissolved soda-ash
¼ „ acetate of soda.

For the dyeings done with 3 % dyestuff and more:
5½ galls. diazotised Paranitraniline C
¾ lb. dissolved soda-ash
6 oz. acetate of soda.

The coupling process is of the greatest importance not only for the production of **Blacks** (Diamine Nitrazol Black B and Oxy-Diamine Black A, JW, JEI), but also for other deep shades, principally **Browns** and Olives, which must be especially fast to washing or to acid cross-dyeing.

The coupling of the different kinds of goods is done as follows:

Coupling Yarn.

Cotton Yarn is dyed as usual in wooden vessels. After dyeing the cotton is well rinsed and entered into the diazo-solution, worked for 30—40 minutes, then lifted and soaped.

Coupling Loose Cotton.

Loose cotton is best coupled without the addition of soda and acetate of soda the quantity of Paranitraniline solution, however, to be increased by one fourth.

Coupling in Dyeing Machines.

Raw cotton, cops, also cheeses, can be dyed and coupled in one apparatus, the whole process being very simple and applicable without difficulty. The diazo-solution is used as described for loose cotton and after coupling the goods can be rinsed and soaped hot.

All those Diamine Colours which can be coupled are suitable for machine-dyeing: Diamine Brown V only owing to its being somewhat less soluble, must be dyed more cautiously by using rather more soda than usual and adding the dyestuff in solution and in several portions to the dye-bath.

Coupling Pieces.

Pieces are dyed on the jigger or in the open vat and are coupled on the jigger or padding machine. The required quantities of diazo solution and acetate of soda are separately added to the coupling bath, and the goods are given two ends.

If large lots have to be coupled it is advisable to have the diazo solution and acetate of soda in separate vessels by the side of the jigger or padding machine and add them gradually, in the necessary proportions, while the goods are running.

Two ends are sufficient in all cases, no matter whether the goods are developed on the jigger or padding machine. Very thick goods are best left on the rollers or in a heap for about $^1/_2$ hour after coupling.

Topping with Basic Colours.

The dyeings obtained with Diamine Colours, either direct or by means of the developing or coupling process, have the property of attracting and fixing Basic Colours, hence they can be brightened or shaded by re-dyeing with suitable Basic Dyestuffs.

This topping simply consists in giving a slight rinsing to the goods after dyeing with Diamine Colours, and entering them into fresh liquor which contains the Basic Dyestuff in solution.

This dyeing is conducted at the ordinary temperature, with the addition of 1 % to 3 % alum, or 3 %–5 % acetic acid for light toppings. In the case of Colours which exhaust quickly, their solution must be added to the bath in two or three portions. The bath towards the end of the operation may be heated to 120° F. (50° C.)

This method of topping with Basic Dyestuff is often resorted to in the case of direct dyeings, as well as with those which have been developed, viz., for shading and brightening the shades of yarn or pieces In the case of piece-goods the method has the further advantage of covering such impurities as motes, dead-cotton, etc., which frequently occur in common goods.

The topping should always be done in a very long bath, i. e. in a large amount of water. A vat, in which 100 lbs. of yarn are **dyed** is just large enough for **topping** 50 lbs. of yarn.

The topping of coupling colours may be effected by simply adding the basic colour, e. g. New Methylene Blue N to the coupling bath before entering the goods.

Topping Diamine Colours with Aniline Black.

A really satisfactory pure Aniline Black (Oxidation Black) is rather difficult to produce, especially on yarn and loose cotton, and since, as a rule, it weakens the fibre not inconsiderably, it has been found advisable in many cases to dye it on a bottom or ground-colour.

In this case, since the fibre is already dyed a comparatively dark shade, the strength of the Aniline Black mordant can be considerably reduced, which not only facilitates the work, but also lessens the danger of the fibre being tendered. Another point in favour of bottomed or grounded blacks is, that they do not turn green as quickly as an ordinary Oxidation Black.

Colours best suited for grounding are Diamineral Black B, and Diamine Jet Black SS and Oxydiamine Black A and JW and B and BG.

In this combination two methods of working can be adopted; one is, to give a weak ground with Diamine Black and top with a strong Aniline solution; the other is, to dye a comparatively full black with Diamine Jet Black SS and top with a weak Aniline solution.

We refrain from giving any further particulars here, since this method has lost its importance since the introduction of our Immedial Blacks, which surpass Aniline Black in every respect We give every information regarding Aniline Black on top of Diamine Colours on special application.

Chapter IV.

Application of The Diamine Colours in Dyeing Loose Cotton.

The Diamine Colours are extensively used in loose cotton dyeing, and their application for this purpose is ever increasing, because of the considerable advantages they offer.

These advantages are

1. **Simplicity of the dyeing process, one hour's boiling being sufficient for the production of most shades.**
2. **Complete preservation of the softness and spinning properties of the cotton, inasmuch as the dyed cotton may be spun in the same high counts as when undyed, and this too with scarcely any waste.**
3. **Facilitating the carding process, and consequently less wear and tear of the cards.**
4. **Absence of colour dust, which is well known to be very objectionable in dyeings fixed with Tannin and Tartar Emetic, or obtained with Cutch and dyewood extracts.**

Other points in favour of the use of the Diamine Colours are the following: they give shades comparatively fast to washing: in pale shades they either do not bleed at all or only very little; with the exception of a few Reds and Bordeaux they are not sensitive to acids; and finally, the majority of them may be diazotised and developed on the fibre.

With respect to the **light shades** dyed with Diamine Colours experience has shown that most of them fulfil nearly every requirement as regards fastness to milling. As for the **deep shades,** those dyed according to the *direct* method are also sufficiently fast for most purposes, especially when fastness to bleeding during milling or washing is not necessary. If however, deep shades specially fast to milling are required, the process of coupling or that of diazotising and developing, or that of fixing the dyed colours with metallic salts, ought, if possible, to be adopted.

In dyeing Diamine Colours on loose cotton, the following methods are available:

(a) Production of direct dyeings.

(b) Production of diazotised and developed dyeings.

(c) Production of coupled dyeings.

(d) Production of dyeings fixed with metallic salts.

(e) Topping of Cutch dyeings with Diamine Colours.

(f) Simultaneous dyeing with Logwood and Oxy Diamine Black, Para Diamine Black, or Diamine Jet Black.

(g) Application of Diamineral Black, Diamine Jet Black S S, Oxy Diamine Black, or Para Diamine Black as a ground colour for Aniline Black (page 55).

(h) Topping of direct dyeings with Basic Dyestuffs (page 80).

Loose cotton is generally dyed in copper vessels, and sometimes in wooden vessels, but more recently dyeing machines very generally have been adopted.

In charging the dye-bath it is advisable to add the ingredients in a certain order, preferably as follows:

When soda is used.	When no soda is used.	When phosphate of soda and soap are used.
Add first, Soda; then Colour; and lastly, Glauber's or Common salt.	First, Colour: then Glauber's or Common salt. N.B. — If the water contains lime a small addition of soda (½ % of the weight of the cotton) is necessary, before the colour is added.	First, Phosphate of Soda: then Soap; and lastly the Colour.

Heat the dye-bath to the boil, enter the dry cotton previously opened out, work the cotton as usual and continue boiling until the required shade is obtained.

In dyeing light shades the dye-baths are generally exhausted, but with dark shades this is rarely the case and the liquors should be kept for further use.

After dyeing, the cotton is rinsed, hydro-extracted and dried. For light shades it suffices to simply rinse the cotton while still in the hydro-extractor.

Regarding the various aftertreatments we refer to the preceding chapter.

Chapter V.

Cotton Hank Dyeing with The Diamine Colours.

The application of the Diamine Colours for cotton hank dyeing has already become so general that it is scarcely necessary to enlarge upon the advantages which they offer for this branch of the dyeing trade.

The following features commend their use: — The **simplicity of the dyeing process; the ease with which they work together,** thus rendering it possible to obtain almost all shades in a single bath by intermixing; further, the **property** of not **impairing** the **strength** and **softness** of the **cotton,** and of producing dyeings which are fast to **rubbing, calendering, perspiration,** and for the most part also to **acids** and **washing.**

The method of dyeing cotton yarn with the Diamine Colours is generally known, but for the sake of completeness a description of the details of the practical working is given here.

A. Dyeing at full boil for one hour.

Suppose 100 lbs. of grey cotton yarn are to be dyed with 4 % Diamine Brown M in the starting bath.

A 8′ × 2½′ × 2′ vat, fitted with a steam arrangement as shown in Fig. 4 is filled to one third of its height with water, the direct steam-conduit opened, and the water brought to boil While this is being done three clean buckets are made ready. In one 1 lb. soda-ash is put, in another 4 lbs. Diamine Brown M and in the third 20 lbs cooking salt. All three are taken to an "S" solution water bucket (that is one containing boiling water corrected with soda-ash) and boiling water poured over the contents while they are being stirred. The buckets containing the soda- and colour-solutions are taken to a loose steam-pipe and the contents boiled while stirring them until completely dissolved.

Add the soda-solution first to the boiling water, then the colour-solution and stir well. Then fill up with cold water, until the quantity of dye-liquor is in proper proportion to the quantity of yarn, viz about 200 gallons for 100 lbs. of yarn. Shut the direct steam-pipe and continue the boiling with **indirect** steam.

The previously boiled yarn, which has been put on dye-sticks, is then entered, each stickfull given a turn by means of the broaching stick and shelved on one side of the vat, the dye-sticks being at the same time turned erect, and not allowed to lie flat, as otherwise there would not be space enough for all sticks. When all the stickfulls are turned once or twice, the yarn is lifted the salt solution given into the bath and the latter stirred well with a rack. Now enter the yarn again and continue to turn the yarn without interruption one stick after the other. This turning at full boiling of the dye-bath is kept up for at least one full hour. Then the steam is shut off and the yarn is lifted, allowed to drain, washed after being cooled down and dried. This is called in short "Working at full boil for one hour".

B. Dyeing at full boil for one hour and working afterwards in the cooling bath.

Supposing it had been found that a certain shade could be obtained in the starting bath by $^1/_4$ % soda-ash, $2^1/_2$ % Diamine Fast Yellow B and 30 % cooking salt, dyeing at full boil for one hour and one hour in the cooling bath, the yarn would be dyed with these ingredients just as mentioned for the 4 % Diamine Brown M shade. After working at full boil for one hour, the steam is closed and the yarn continued to be turned for one hour in the dye-bath, which thus gradually cools down. The yarn is then lifted, allowed to drain, washed in due time and dried.

Whereas in the two preceding processes the bath is not entirely exhausted and a considerable part of the colouring matter remains in the liquor, the best possible use of dyestuff is made in the two following methods.

C. Dyeing in consecutive lots at one hour's full boil each.

Supposing a lot of 800 lbs. of yarn is to be dyed in the same shade as example A, the best method will be as follows:

The first lot of 100 lbs. of yarn is dyed with 4 % or 4 lbs. Diamine Brown M as mentioned in A. As soon as the dyeing is finished, the steam is shut, the yarn lifted and the liquor allowed to drain back into the vat

For each following lot of 100 lbs of yarn is added to this old liquor:

½ to 1	oz.	soda-ash
3	lbs	Diamine Brown M
5 to 10	„	Glauber's salt

and as much water as necessary. The way of working is then again exactly the same as for the first lot.

D. Dyeing in consecutive lots and aftertreating in consecutive lots.

A lot of 800 lbs. of yarn to be dyed to a shade obtained in the starting bath with 1 % soda-ash, 4 % Diamineral Black B, 2 % Diamineral Blue R, 1 % Diamine Fast Yellow B and 30 % cooking salt at full boil for one hour.

Work the first lot of 100 lbs. for one full hour, lift, allow to drain for a few minutes into the vat, and put on yarn rests. Then shut the steam and add for each following lot of 100 lbs. of yarn:

4	oz.	previously dissolved soda-ash	Observe the reduction of these quantities against those of the first bath!
3	lbs.	„ „ Diamineral Black B	
1½	„	„ „ „ Blue R	
¾	„	„ „ Diamine Fast Yellow B	
10	„	„ „ cooking salt and	

water as much as necessary.

Open steam, bring to boil and work each lot at a full boil for one hour just like the first, allow to drain and put on to yarn rests or throw in heaps.

Next morning the dyed yarn is well washed and then aftertreated, lot by lot in a consecutive way again. Fill a 8′ by $2^1/_2$′ by 2′ dye vat to half its height with water, open the direct steam conduit, allow to boil up, add for the first lot of yarn:

2 lbs. good acetic acid, stir well, then add
$2^1/_2$ „ previously dissolved sulphate of copper and
$2^1/_2$ „ previously dissolved bichromate of potash or of soda, stir and fill the vat with water as much as required, bring this to a full boil. Shut the direct steam conduit and open the indirect one. Then enter the yarn previously put on dyesticks and turn it at full boil for 10 - 15 minutes, lift, allow to drain in the vat for a few minutes and put on yarn rests.

For each following lot, add to the old aftertreatment bath:

$^1/_2$ lbs. good acetic acid
$1^1/_2$ „ previously dissolved sulphate of copper
$1^1/_2$ „ „ „ bichromate of potash or soda, and water as much as necessary

Then open the steam and bring to boil and treat each lot as the first one at half an hour's full boil. As soon as the aftertreatment is finished, the yarn must be thoroughly washed in order to remove every surplus of bluestone and bichromate.

E. Dyeing pale shades.

To produce e. g. a pale pink on 100 lbs. of yarn with $^1/_8$ % Diamine Rose BD, the method is as follows:

The yarn is bleached as explained in Chapter II. Then make 2 lots of 50 lbs. each, 100 lbs. being rather too much for dyeing such a delicate shade in one lot.

Each lot of **50 lbs.** is dyed in a clean 8′×$2^1/_2$′×2′ vat as follows:

Charge the vat for 50 lbs. of yarn, for not more than one sixth of its height with water, bring to the boil, add 1 lb. previously dissolved soda-ash and stir well, then shut the steam. Add 1 lb. previously dissolved soap and stir well, then add

1 oz. or say 2½ tolas previously dissolved Diamine Rose BD and 2½ lbs. previously dissolved salt and stir well. Fill the vat with cold water. Enter the yarn and work it for half an hour without steam, then open the indirect steam and bring the bath slowly to the boil, continue boiling for ¼ hour, close the steam and turn in the cooling bath as long as required.

The whole operation will take about 1 hour. Then lift, allow to drain and wash well after a few hours in fresh water.

F. Dyeing a pale shade and treating it afterwards with metal salts.

A shade arrived at with ¼ % Diamine Orange B, 1/16 % Diamine Fast Yellow B treated with 1½ % sulphate of copper has to be dyed on 50 lbs. of grey yarn Proceed as follows:

Charge a clean 8′ × 2½′ × 2′ vat to not more than one sixth of its height with water, bring to the boil, add ¾ lb. previously dissolved soda, stir well and shut the steam. Then add 2 ounces or 5 tolas previously dissolved Diamine Orange B and ½ ounce or 1¼ tolas previously dissolved Diamine Fast Yellow B and stir well, then add 3½ lbs. previously dissolved salt, stir and fill the vat with cold water. Enter the previously boiled yarn, turn for ¼ hour, open the indirect steam conduit and bring to boil, boil ½ hour, shut the steam, turn ½ hour in the cooling bath working the yarn all the while, lift, allow to drain and put on yarn rests and wash after a while.

In a vat of equal dimensions put water to half its height, bring to the boil, add 1 lb. acetic acid and stir very well, then add ¾ lb. previously dissolved sulphate of copper and stir, fill the vat with water and bring to about 175° F. (80° C.), then close the direct steam conduit and open the indirect one. Enter the washed yarn and work hot for ¼ ½ hour, lift, let the yarn cool down and wash.

If say 400 lbs. of grey yarn would have to be dyed to the shade just mentioned, it would be advisable to **dye** each lot separately, that is to say in a fresh dye-bath. Very light **compound** shades ought not to be dyed in consecutive lots, otherwise the third, or fourth lot would as likely as not show a shade slightly different from the original one. A saving could however be made by **aftertreating** the 400 lbs. in eight **consecutive** lots:

The first lot would be treated as above said, for the following lots:

$^1/_4$ lb. acetic acid
and $^5/_8$ „ previously dissolved sulphate of copper

would have to be added each time to the old aftertreatment bath.

Each lot of 50 lbs. would of course have to be worked in the sulphate of copper bath for $^1/_2$ hour, just like the first one.

G. Dyeing a pale shade in consecutive lots and treating it afterwards with metal salts in consecutive lots.

A shade arrived at in the starting bath with 1 $^0/_0$ Diamine Fast Red F treated with 1$^1/_2$ $^0/_0$ fluoride of chrome has to be dyed on 500 lbs. of grey yarn in lots of 50 lbs. Proceed as follows:

Charge a clean 8′ × 2$^1/_2$′ × 2′ vat to utmost one sixth of its height with water, bring to boil, add $^3/_4$ lb. previously dissolved soda, stir well and close steam. Then add $^1/_2$ lb. previously dissolved Diamine Fast Red F and stir well, then add 6 lbs. previously dissolved salt, stir and fill the vat with cold water. Enter 50 lbs. of the previously boiled yarn, turn for $^1/_4$ hour, open the indirect steam conduit and bring to boil, boil 1 hour, close steam, turn $^1/_2$ hour in the cooling bath working the yarn all the while of course, lift, allow to drain and put on yarn rests.

Add for the second and each following lot to the old dye-bath:
$^1/_8$ lb. previously dissolved soda-ash
$^1/_2$ „ „ „ Diamine Fast Red F, this because Diamine Fast Red F exhaust in such pale shades completely
2 „ „ „ salt and
cold water as much as necessary.

Enter the yarn, turn for $^1/_4$ hour, reopen steam bring to boil, boil one hour, turn half an hour in the cooling bath, lift, allow to drain and put on rests and wash the whole lot after a while.

In a vat of equal dimension put water to half its height, bring to boil, add one lb. acetic acid and stir well, then add $^3/_4$ lb. previously dissolved fluoride of chrome and stir, fill the vat with water and bring to full boil, then close direct steam conduit and open the indirect one.

Enter the washed yarn and work boiling for $^1/_4$—$^1/_2$ hour, lift, let the yarn cool down and wash.

For the following lots:

4 oz. acetic acid and
10 „ previously dissolved fluoride of chrome

have to be added **each** time to the old aftertreatment bath.

Each lot of 50 lbs. has of course to be worked in the fluoride of chrome bath for $^1/_4$—$^1/_2$ hour, just like the first one.

H. Dyeing very light compound shades on grey yarn.

For very light shades and especially for very light compound shades it is best to begin dyeing in a cold bath and to heat it gradually.

If, for instance, a shade obtainable with 0.375 % Diamine Dark Blue B, 0.075 % Diamine Orange D and 0.025 % Diamine Fast Yellow B is to be dyed on 50 lbs. of yarn, the following procedure is resorted to.

A 8'×$2^1/_2$'×2' dye vat is filled to half its height with cold water, then 1 lb. previously dissolved soda-ash is added and the whole stirred. Then $7^1/_2$ tolas previously dissolved Diamine Dark Blue B, $1^1/_2$ tolas previously dissolved Diamine Orange D and $^1/_2$ tola previously dissolved Diamine Fast Yellow B are added and the whole stirred, lastly $2^1/_2$ lbs. previously dissolved salt are added and the vat filled as much as necessary with **cold** water. The wet yarn is entered and turned for $^1/_4$ hour, when the indirect steam conduit is opened and the bath brought slowly to the boil, whilst turning the yarn constantly. Then steam is shut again and the goods worked in the gradually cooling bath for another $^1/_2$ hour, lifted and when perfectly cold, washed very well.

I. Washing and drying dyed yarn.

Dyed yarn is washed in cold water.

It is sometimes advisable to soap dyed yarn. This is done by turning the dyed yarn for 20 minutes or so in a warm bath containing 1 % to 3 % soap, then drying it.

For blacks an "oiling" process is sometimes applied, which increases the lustre of the black a great deal. Prepare a boiling solution of 4 lbs. soap in 10 gallons water, stir 2 pints olive oil into it and pour this mixture into about 200 gallons of luke warm water. Work the dyed and washed yarn in this bath for 20 minutes, wring and dry.

Regarding the various aftertreatments of dyed yarn we refer to pages 45—60.

Chapter VI.

Application of The Diamine Colours in Piece Dyeing.

The many advantages possessed by the Diamine colours, as mentioned in the beginning of Chapters IV and V, constitute one of the principal reasons for their increasing application in piece dyeing.

The Diamine colours are employed not only for the ordinary kinds of light cotton cloth, but very extensively for the more valuable goods such as velveteens, cloakings, coatings, moleskins, beaverteens etc.

Piece goods are dyed by any of the following methods:

(a) **in the ordinary open Dye bath,**
(b) **on the Jigger,**
(c) **on the Padding Machine.**

(a) Dyeing in the open Dye bath.

This method of dyeing, in addition to being the oldest, still finds great favour for light goods. When dyed in the open vessel the shades always appear brighter than when dyed on the jigger, but since the baths do not exhaust so well — and this is a point of some importance in the case of heavy shades — it is well to dye these on the jigger, using the open vessel for dyeing the lighter shades.

According to the nature of the dyestuffs employed use the following additions:

If dyed with Soda	If dyed without Soda	If dyed with Soap and Phosphate of Soda
For light shades 2 % soda and 10 % common or Glauber's salt, for dark shades 2 % soda and 20 % Glauber's or common salt, the additions to be made in the following order: 1st soda, 2nd colour, 3rd common or Glauber's salt	For dark shades 20—30 % common or Glauber's salt. When using calcareous water add to the dye-bath 1st ½ % soda, 2nd colour, 3rd common salt. The soda is reckoned on the weight of the goods. Light shades are seldom dyed without soda or soap.	With 10 % phosphate of soda and 2 % soap. In using calcareous water add 1st ½ % soda, 2nd phosphate of soda and soap. 3rd colour. This method is best suited for producing very pale shades.

If working in very dilute baths, *i. e.*, when the quantity of the liquor is more than twenty times the weight of the goods to be dyed, it is advisable not to calculate the quantity of salt on the weight of the goods to be dyed, but approximately on the volume of water contained in the bath. This is especially of importance when dyeing dark shades, in which case, supposing 2 % soda and 20 % Glauber's salt on the weight of the goods are prescribed, $^2/_5$ oz. soda and 2 oz. Glauber's salt per gallon of water would have to be used.

In dyeing **light shades** or in the case of goods which are difficult to dye *through*, it is advisable to work with plenty of water. The dyeing is started at 105° F. (40° C.), the temperature being slowly raised to 140–160° F. (60–70° C.).

For **dark shades** dye in as little water as possible and use, if at all available, vessels heated by indirect steam. Enter at 140—160° F. (60—70° C.), raise to the boil and allow the goods to run until the desired depth of shade is obtained.

For dyeing in consecutive lots, diazotising and developing and topping with basic colours we refer to the corresponding chapters.

(b) Dyeing on the Jigger.

The jigger is the piece dyeing machine most generally used.

For **pale shades** and for **closely woven materials**, which do not dye easily level, charge the jigger with

$^1/_4$—$^3/_4$ oz. soda and } per gallon of water
$^1/_4$—$^3/_4$ oz. soap or Turkey-red oil }

and add one half of the dissolved colour. Give the goods one end, light goods at 140° F. (60° C.), heavy goods at the boil; add the remainder of the colour solution and give a few more ends. Then add per gallon of water,

$^1/_2$–1 oz. Glauber's salt,

and finish dyeing in two or more ends according to requirement.

If specially heavy goods are to be dyed in pale shades, 6—8 ends should be given, with an addition of soda, soap and colour, adding the Glauber's salt at a later stage.

For dyeing **dark shades on thin goods,** charge the jigger with $^1/_4 - ^3/_4$ oz. soda per gallon water and the necessary quantity of colour solution, give two ends at the boil. add $1^3/_4 - 3^1/_4$ oz. Glauber's salt in several portions and continue boiling until the shade is attained.

For **goods which are difficult to dye through,** it is best to add

$^1/_4 - ^3/_4$ oz. Turkey-red oil per gallon water

along with the soda and to add the Glauber's salt gradually, in small portions after the fourth end.

Whenever the addition of soda is not admissible, it can be replaced with an equal weight of Turkey-red oil.

It is of course impossible to say what number of ends should be given in any particular case, but for most goods and shades 10—12 ends are sufficient, which for a lot of from 500—600 yards length would require about $1^1/_2$ hour's dyeing; frequently, however, 5—8 ends will be found sufficient.

When dyeing light or medium shades on the jigger even if the bath is not exhausted entirely, so little colour is left in the liquor that it would not be profitable to preserve it.

For dark shades however the old bath is usually retained, in which case the salt is replenished by adding one third of the original quantity.

Some examples taken from practice, showing the proportion of material used when dyeing on the jigger, will serve to explain the above.

Bluish Grey. 10 pieces Lining, 60 yds. each (150 lbs.)

5	ozs	Diamine Dark Blue B.
$1^1/_4$	„	Diamine Catechine B,
$^1/_4$	„	Diamine Fast Yellow B,
$1^1/_2$	lbs.	soda,
6	„	Glauber's salt.

Give two ends with colour and soda only, at about 175° F. (80° C.), then four ends at the boil, gradually adding the Glauber's salt.

Pale Brownish Drab. 10 pieces Satteen, 60 yds. each.

1	lb.	Diamine Orange G,
6	ozs.	Diamine Catechine B,
1/4	„	Diamine Dark Blue B,
1	lb.	soda,
6	lbs.	Glauber's salt.

Give two ends with colour and soda only at about 175° F. (80° C.), then eight ends at the boil, gradually adding the Glauber's salt.

Buff. 10 pieces Satteen, 60 yds each.

5	ozs.	Diamine Orange G,
1/2	„	Diamine Catechine B,
1	lb.	soda,
6	lbs.	Glauber's salt.

Dye same as the Pale Brownish Drab.

Pale Linen Drab. 8 pieces Moleskin.

2	ozs.	Diamine Catechine B,
3	„	Diamine Fast Yellow B,
1/2	„	Diaminogene extra,
12	„	soda,
12	„	soap,
1	lb.	Glauber's salt.

Give eight ends at the boil with soda, soap and colour only, then two ends with the further addition of Glauber's salt.

Dark Navy. 3 pieces Cloaking, 300 yds. weighing 200 lbs

8	lbs.	Diamineral Blue R,
1	„	Diamine Violet N,
2	„	soda,
15	„	Glauber's salt

Give at first two ends at the boil with soda and colour only, then 10 ends, adding the Glauber's salt gradually in small portions.

The **diazotising** and **developing** is done on the jigger, and for this purpose either one or two jiggers may be used. The pieces must be washed in cold water after dyeing, then diazotised, washed and developed.

Charge the jigger with cold water, and add **for each 10 lbs. weight of goods:**

5 oz. nitrite and 1 lb. hydrochloric acid.

Give two ends, then let the liquor run off and prepare a fresh bath containing 1 gall. hydrochloric acid per 100 galls. water and give two ends; then take out, and finally develop in a fresh bath prepared with the requisite developer in solution, selected of course according to the shade required. See pages 48—52 for the quantities to be employed.

For light goods give two ends in the developing bath, for heavy goods four ends, then wash thoroughly.

As a rule, the total quantity of nitrite and hydrochloric acid can be added simultaneously to the jigger, but when large rolls of goods are to be diazotised, it is better to add it gradually in several portions. The same remark also applies to the addition of the developing liquor.

The shade is in no way influenced by the concentration of the developing bath. So long as the rules here given are observed, the result will always be the same, since the shade ultimately obtained depends entirely upon that previously produced in the dye bath.

It is necessary therefore to always preserve patterns both in the undeveloped and developed conditions, the former being the one to consult during the operation of matching.

For continuous diazotising and developing, the arrangement shown below (sketch 33) is recommended.

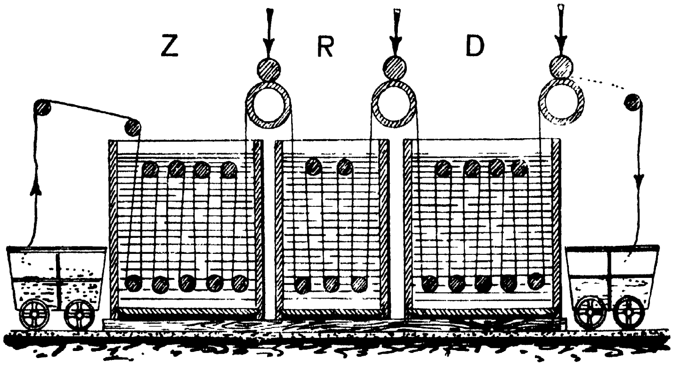


Fig. 33. Z - Diazotising Vat. R - Rinsing water acidulated with hydrochloric or sulphuric acid. D—Developing Vat.

For continuous feeding of the diazotising and developing bath small tanks or tubs are arranged above the vats as follows:

A tub No. 1 with nitrite solution; }
A „ „ 2 with dilute hydrochloric or sulphuric acid } above Z
A „ „ 3 with the developing liquor, above D.

To develop a black on pieces of about 200 lbs. dry weight, prepare the following solutions:

In tub No. 1: 6 lbs. nitrite in 20 gall. water,
„ „ „ 2: 20 „ muriatic acid in 20 galls. water,
„ „ „ 3: 3 galls. Diamine-solution in 20 galls. water.

After dyeing, the pieces are washed in an ordinary dye-vessel or in a jigger with cold water and are then passed continuously through the three vats, Z, R, and D. At the beginning, $^1/_{10}$ of each of the requisite solutions is added to the several vats half filled with cold water, and the remainder is gradually added during the passage of the pieces.

After developing, wash and if necessary, soap.

Some prefer to wash the pieces at the moment they leave the developing bath by passing them through a fourth vat arranged in line with the others

For the purpose of stitching together two lots of pieces. the machine may be stopped without causing any defect. The position of the machine should be such that it is protected from the direct rays of the sun.

The **after treatment with Metallic salts** can be done either on the jigger or on the open-width dyeing machine. The proportions mentioned in Chapter III are also applicable here.

The **topping with Basic Colours**, so frequently carried out in connection with piece dyeing, and which not only brightens the shades but also covers the burls, dead-cotton, etc. in low class goods, may be done either on the jigger or on the padding machine.

Dye cold with the Basic Colour with the addition of acetic acid or a little alum. When the bath is exhausted it may be heated to 95 105° F. (35—40° C.)

Since both the direct and the developed dyeings attract the Basic Colours very rapidly, it is advisable to add the colour solution gradually in small portions.

(c) Dyeing in the Padding Machine.

The padding machine is principally used for dyeing light or medium shades.

Two methods can be used when dyeing on the padding machine.

(1) The wet goods are dyed in the same way as on the jigger, but on account of the pressure of the rollers not so many passages are necessary. Thin cotton cloth is mostly dyed in the following manner and the details given in the chapter on jigger dyeing are also applicable here. The colour box is charged with water and part of the colour, adding the same proportion of salt as in jigger dyeing, 4–6 ends are then given, and part of the colour solution is added with each end. For instance.

Blue Grey. Five pieces Twill, 420 yds. (about 80 lbs.)

12	galls.	water,
¼	lb.	soda,
3	ozs.	Diaminogene extra,
1	oz.	Diamine Catechine B,
1½	lb.	Glauber's salt.

First add the soda, then part of the colour solution and of the Glauber's salt; give four ends at a temperature a little below the boiling point, adding with each passage a portion of the remaining colour solution as well as of the Glauber's salt.

Dark Bronze. Three pieces Lining, 258 yds. (about 75 lbs.)

12	galls.	water,
¼	lb.	soda,
11	ozs.	Diamine Dark Blue B,
5	„	Diamine Catechine B,
9	„	Diamine Fast Yellow B,
1½	lb.	Glauber's salt.

First add the soda and Turkey-red oil, then part of the colour solution and of the Glauber's salt; give six ends at the boil, adding with each end a little of the remaining colour solution and Glauber's salt. After the fourth end a pattern may be taken for matching, and the quantity of colour still to be added is then decided upon.

(2) The second method consists in dyeing on the padding machine with an addition of dextrine or starch, in which case the goods are run into the pad in a dry condition.

This method is specially recommended whenever large lots of goods are to be dyed to the same shade. For a long time pale shades have been produced by this method of padding, but of late it has been successfully applied in the production of medium and dark shades, hence a detailed description of it may not be out of place here.

The padding machine with three squeezing rollers is the most suitable, although the ordinary two-roller machines will be found quite serviceable if the other is not at command.

The wooden colour trough should hold 12—18 gallons and be provided with a copper, or still better, a leaden steam coil.

The goods are run through two nips, pale shades at 105—120° F. (40—50° C.), dark shades at 160—180° F. (70—80° C.).

For light self colours one passage is sufficient, but for compound shades two to four are generally required.

All the Diamine Colours are suitable for the production of self-shades by padding in the padding machine. For the production of mixed shades by padding the following dyestuffs are recommended which combine well with each other:

Diamine Black BH
Diaminogene extra, B
Diamine Jet Black
Diamine Fast Black
Oxy Diamine Black
(with the exception of Oxy Diamine Black N)
Para Diamine Black
} all brands in pale and medium shades
Diamine Dark Blue B
Diamine Fast Blue FFB, FFG, G
Diamine Sky Blue
Diamine Sky Blue FF

Diamine Blue 2B, 3B, RW
Diamine Brilliant Blue G
Diamine Azo Blue 2R
Diamineral Blue R, CV, CVB, B, 3B
Diamine Green G, B, CL
Diamine Dark Green N
Diamine Heliotrope G, B, O
Diamine Bordeaux B
Diamine Brilliant Bordeaux R
Diamine Violet Red
Diamine Red 4B, 10B

Diamine Fast Scarlet, all brands
Diamine Brilliant Scarlet S
Diamine Rose BD, BG, GD
Direct Rose T
Diamine Brown M, R, S
Diamine Catechine B, G, 3G
Diamine Fast Brown G, R, GB
Oxy Diamine Brown G, 3GN, RN
Diamine Orange D, G
Diamine Fast Orange EG, ER
Oxy Diamine Orange G
Diamine Fast Yellow A, AGG, B, FF, M
Diamine Yellow CP
Oxy Diamine Yellow TZ, GG
Thioflavine S.

The only additions required other than the colour solution are $1\frac{1}{2}$ oz. dextrine and $\frac{3}{4}$ oz phosphate of soda per gallon of water.

For low qualities of goods the dextrine may be replaced by starch.

The washing after padding can be omitted with most light shades, especially on linings, and the pieces may be dried and finished immediately after padding. When drying on copper cylinders it is advisable to wrap around the first drums coarse calico. Any errors in shading may be rectified in the finishing process by suitably colouring the starch paste.

The following are a few recipes for the production of different shades by the padding process just described:

Dark Grey. Fast to hot pressing.

20	galls.	water,
1	lb.	Diamine Dark Blue B,
$1\frac{1}{2}$	lbs.	Diamine Catechine B,
$2\frac{1}{2}$	ozs.	Diamine Fast Yellow B.
2	lbs.	dextrine,
1	lb.	phosphate of soda,
$3\frac{1}{4}$	ozs.	soap.

Two passages at 140° F. (60° C.).

Light Heliotrope. Fast to hot pressing.

20	galls.	water,
10	ozs.	Diamine Violet N,
2	lbs.	dextrine,
1	lb.	phosphate of soda.

Two passages at about 140° F. (60° C.).

(d) Dyeing in the Continuous Dyeing Machine.

In the continuous dyeing machine mostly staple shades such as Black, Brown, Dark Blue, etc. are dyed.

Oxy Diamine Black for instance is dyed in a roller box containing four compartments, constructed as shown in the sketch on page.

Each compartment is provided with squeezing rollers, the upper ones in each case being coated with rubber; openers are fixed before each pair of rollers. The liquor is heated by means of indirect steam.

The grey goods are boiled in the first compartment (a) which is charged with 3½ lbs soda ash and freshened up during the passage with ½ % soda ash of the dry weight of the goods. This bath turns rapidly brown and dirty owing to dissolved size and other impurities, and is therefore renewed twice daily.

The three dyeing compartments (b), with a combined capacity of about 650 gallons liquor, are charged with equal quantities of dye liquor, at first with

2½ lbs Oxy Diamine Black AT or JB
dissolved together with some soda | per 10 gallons liquor
and replenished during the passage with

5 - 5½ % Oxy Diamine Black of the weight of the goods to be dyed.

For a daily output of 100 pieces of a total weight of about 2650 lbs, the additions required foor keeping the bath at its full strength are

145 lbs Oxy Diamine Black and
13 lbs soda dissolved in
130 gallons water,

and after each piece has passed, 1⅓ gallon of this solution is added, equally divided between the three compartments.

The speed of the machine is so regulated as to allow the pieces to remain for about three minutes in contact with the liquor.

These machines are as a rule provided with a small automatic meter which rings a bell after each 100 - 120 yards, thus announcing when the colour solution is to be added. It is, however, not of very great importance for the addition to be made at perfectly regular intervals since small deviations therefrom have no detrimental effect on account of the high concentration of the bath.

Having passed through the machine, the goods ar laid off in a truck and rinsed when cold. It is of advantage to let the goods lie for a little while without rinsing, but the latter should not be unduly delayed as it is then less easy to clean the goods thoroughly.

Chapter VII.

Application of The Basic Colours in Cotton Dyeing.

Basic colours are those dyestuffs, in which the essential component part is of basic or alkaline character In consequence of their chemical constitution, Basic colours have no direct affinity to the cotton fibre. Therefore, in order to successfully dye Basic colours on cotton, a connecting link is necessary to bring about the combination between cotton fibre and Basic colour, and this connecting link is called **Mordant.**

Thus, Basic colours as for instance Fuchsine, Magenta, Zavahir-Green, Royal Green L C, New Methylene Blues, Bright Violet Extra R, Thioflavine T, Auramines, Safranines, Naphtindones, Irisamines etc. are fixed on the cotton fibre by means of Tannate of Antimony (i. e Tannic acid and Antimony salts). On the one side this Tannate of Antimony can easily be prepared in an insoluble form on the cotton fibre whilst on the other side it combines very firmly with all basic dyestuffs.

It is therefore evident, that to arrive at satisfactory results, the cotton material must first be impregnated with Tannic acid, then treated with Antimony salt, **"mordanted"**, and then only dyed with basic colours.

Tannin

Tannin or Tannic acid is a substance of vegetable origin and is contained in Gallnuts, Myrabolam nuts, Sumac-leaves and twigs, Bablah (in vernacular called baval-na-purda) Divi-divi, out of which it can be easily extracted with hot water. There exist in Europe special factories, which extract the Tannin out of those vegetable matters, purify it and sell it as Pure Tannin. Such pure Tannin is of very easy manipulation and of uniform strength, being almost chemically pure.

In India preference is naturally given to Myrabolams, which do very well on the whole: only for delicate shades the fact that Myrabolams give a lightbrown tint to the cotton material, will stand in the way of its use and Tannin is used instead.

NB. We have issued a special shadecard: "Volume C. Basic Colours on Indian Cotton Yarn" in connection with the remarks of this chapter.

It is rather difficult to give an estimate of the amount of Tannic acid contained in Myrabolams, Divi-divi etc.

Best quality Myrabolams contain	25—40 %	Tannin
Best quality Bablah contain about	20 %	„
Best quality Sumac leaves contain about .	17—26 %	„
Best quality Divi-divi contain about . . .	20—35 %	„

From this it appears, that one might pretty safely reckon three parts of best Myrabolams to be equal to one part of refined Tannin.

Antimony iron etc.

The Tannic acid alone, being easily soluble in water, would not remain on the cotton fibre during the dyeing process if not transformed into an insoluble salt, mostly into Tannate of Antimony. This **"fixing"** of the Tannic acid is done with Tartar Emetic or with Antimony salt, both yielding equally fast combinations in regard to insolubility in water and fastness to washing.

Instead of Antimony salt sometimes other salts of Antimony or salts of other metals are used, e. g. Basic Alum, Chloride of Tin or Acetate of Iron. The Antimony salts however are leading and most generally used, yielding the fastest mordants in every respect. Acetate of iron forms with Tannin a bluish grey tint, which is sometimes wanted as a bottom for dark blues, browns etc.

Dyeing.

The cotton, after being prepared with Tannin and Antimony salt, has so great an affinity for basic dyestuffs, that the dyeing is begun in a lukewarm or even cold and rather diluted bath. The colour is generally taken up very quickly and must be added to the dyebath **gradually**, in order to ensure perfectly even shades. Only after the colour is almost exhausted, the dyebath is heated up in order to make the combination between fibre, mordant and colour complete and solid.

We give in the following a more detailed description of the mordanting and dyeing process.

DIRECTOR OF INDUSTRIES.
LIBRARY.
JAN. 1923
BENGAL.

Mordanting cotton yarn.

a) **With Myrabolams and Antimony salt.** The Myrabolam nuts are dried in the Sun, opened, the seeds, which contain little or no Tannin at all, are removed and the shells ground to a fine powder. Then pour upon 12 lbs. of Myrabolam powder, 20 to 25 gallons boiling hot water, keep the solution hot for one to two hours, **but do not boil.** This is done best in a large wooden bucket. Then sieve this solution through a piece of shirting into the vat, add 1 lb. country vinegar (made from Palmyra sugar) or $^{1}/_{2}$ lb. acetic acid, mix well and fill the vat with lukewarm water, up to not more than 180- 200 gallons. This represents the Myrabolam bath for 100 lbs. of cotton yarn.

The previously well boiled and perfectly wet yarn is given 6 to 10 turns in this Myrabolam bath, then steeped into it together with the sticks, so that no part of the yarn is out of the liquor. The yarn is kept in this bath for 12 hours, over night. Next morning it is lifted out, drained, well wrung and passed at once into the Antimony bath

The Myrabolam bath can be used for further lots, as only about one half of the Tannin is taken up. For a second 100 lbs. of cotton yarn 6 to 8 lbs. of Myrabolam powder and $^{1}/_{4}$ lb. acetic acid would be sufficient.

The Antimony bath is prepared, by adding 1 to $1^{1}/_{2}$ lbs. Antimony salt previously dissolved in the cold water and stirring well. Then enter the yarn and give 8 to 10 turns rather quickly. Lift out the yarn and wash well in cold water. After this the yarn is ready for the dyebath.

b) With Tannin and Antimony salt. Dissolve 3 to 6 % (of the weight of cotton yarn) of Tannin in hot water and stir this solution into the dye vat, fill with water and heat the liquor up to 160 ° F. (70° C.). Enter the previously well boiled and perfectly wet yarn. Give 8 to 10 turns and steep the yarn together with the dyesticks for 2 to 4 hours in the Tannin bath. Then lift, give a few more turns, wring well or hydroextract and treat the yarn with 1 % to 1½ % Antimony salt exactly as mentioned in a).

The Tannin bath can be used for further lots by adding for each new lot half of the original quantity of Tannin.

Mordanting Loose Cotton.

The loose cotton as it comes from the bale is passed once or twice through the opener and may be put direct into the Myrabolam or Tannin-bath, but it is certainly better ex- pecially if a standing tannin-bath is used, — to previously boil off the cotton with $1/2$ % soda. The method remains the same as prescribed in the previous sections. In case the **dry** cotton is entered into the tannin bath, the latter must be heated up to boiling point, so that the cotton becomes thoroughly soaked. The cotton is left in the bath over night and by some sticks or boards prevented from rising out of the liquor.

The cotton is taken out next morning, drained, hydro-extracted and put at once into the cold Antimony bath. The working is exactly the same as prescribed in a and b.

Mordanting Cotton Piece Goods.

Piece goods are mordanted either like yarn in an ordinary vat, better on a padding machine or in a jigger provided with squeezing rollers.

When mordanting in the jigger or padding machine, the quantity of mordant must be increased, the proportion being 3 oz. to 1 lb. Tannin for 10 gallons of liquor. The goods are passed 4—6 times through the bath at 140—160° F., (60- 70° C.) and then left rolled-up for 2—4 hours.

When using Antimony Salt instead of Tannin, only half to one-third of the above-stated quantity of mordant is required.

Method of Dissolving Basic Colours.

The basic colours should be dissolved with great care. It is best to use condensed water or water slightly acidulated with acetic acid or country vinegar. It is also very important that **the water be boiling hot,** when poured over the colour.

The dyestuff is mixed in a wooden or stone vessel with acetic acid or country vinegar to a uniform paste, then the boiling water is poured over, while continually stirring. For 1 lb. of colour at least 10 gallons of water should be used, to ensure perfect solution.

Auramine and Myrabolam Patent Yellow require no acetic acid and the water should be not hotter than 175° F. (80° C.).

Though most of our basic colours are easily soluble, when dissolved exactly according to this prescription, it will be good to filter the solution through a sieve or a piece of thin cloth, before adding the same to the dye-bath.

Method of Dyeing Basic Colours.

The dyeing with Basic colours is always started in a cold or lukewarm bath and the temperature is raised not before the colour is nearly exhausted.

Amount of water.

The amount of dyeliquor is also a matter of some importance, though of small influence from the economical point, since almost all Basic colours are perfectly exhausted from a long bath as well as from a short bath. But it makes a difference in regard to evenness of shade In an 8′ × 2′ 6″ × 2′ vat, holding 200 gallons, 75 lbs. to 100 lbs. of yarn can be dyed in a medium or dark shade, but only 50 lbs. should be dyed, when a light shade is produced.

Additions to the dyebath. Acetic acid.

When dyeing with Basic colours in calcareous water, some acetic acid must be added to the dye-bath. Acetic acid prevents the lime from precipitating the colour and at the same time causes the colour to go on the fibre slow and evenly. As a rule 1 lb. of acetic acid is sufficient for a 200 gallons bath, that is a vat of 8′ × 2′ 6″ × 2′. If the water contains much lime, the quantity may be raised to $1^1/_2$ lbs. of acetic acid.

Alum.

Some Basic colours go on mordanted yarn so very quickly, that acetic acid alone is not sufficient to ensure even shades. Then $^1/_2$ % to 2 % alum or sulphate of alumina is given into the bath besides the acetic acid

For light shades, which are more difficult to dye even, the quantities of acetic acid and alum are better not reduced.

Preparation of the Dye-bath.

Fill the dyevat to half its height with cold water, add the acetic acid and the previously dissolved alum and stir well with a rack. Then add part of the dyestuff solution say one fourth or one third, stir again and fill up the dye vat with water to the proper mark.

The yarn, after being mordanted and washed, is placed upon the dyesticks, entered into the cold dyebath and **continually turned,** until the colour is exhausted. Then the yarn is lifted, for adding another portion of the colour and again continually turned.

After all the colour is added and almost gone on the fibre, the bath is heated slowly to 140—160° F. (60—70° C.) as the heat completes the fast combination between Tannin and colouring matter.

The yarn is then taken out, washed hydroextracted and dried.

Loose cotton and Piece Goods

are dyed exactly like yarn. For piece goods usually a jigger is employed, an open vat with a winch or the padding machine may also be used. The additions to the bath are exactly the same as mentioned before.

Method of Dyeing Naphtindones.

As the demand for Naphtindones is constantly increasing on account of their superior qualities, we think it opportune to give in the following more explicit details about the application of this product

Mordanting.

Mordanting with Tannin and Antimony salt or Myrabolams and Antimony is done exactly as described before.

Dissolving the colour.

Mix in a wooden or earthen vessel the Naphtindone powder say 3 lbs. with its equal weight acetic acid (3 lbs.) to a uniform paste, then pour 15 galls. boiling hot water, which is corrected with a little acetic acid, over the paste and stir for some time. As a rule it is necessary to boil this solution for 10 to 20 minutes.

Dye-bath

Suppose, in a vat of 8′ 2′ 6″ 2′ 100 lbs of yarn are to be dyed with 3°/o Naphtindone BB. Fill the vat to half its height with cold water, then add ½ lb. acetic acid or 1 lb. "Country Vinegar" and 2 lbs. Alum, previously dissolved in water. Then add about one third of the colour solution and fill the vat with cold water up to 250 galls. mark.

The yarn, which is still perfectly wet, is entered into this cold bath, and turned rather quickly until the colour is completely exhausted. Then the yarn is lifted out, the second third of colour solution added to the dyeliquor, stirred and the yarn entered again and turned, a. s. o. until all the colour is given into the dyebath.

As soon as the colour is exhausted or nearly exhausted, steam is opened and the bath brought gradually to boil, whilst the yarn is continually turned. The yarn is kept in the **boiling** bath for 20 to 40 minutes. After dyeing the yarn is slightly rinsed and dried.

In Europe the mordanted yarn is first taken through the alum alone and then the colour is added gradually. Prepare the dye-bath with alum only, enter the yarn, turn 4 to 6 times, lift, add part of colour solution etc. etc. and finish as described above. This previous treatment with alum causes the colour to go on very evenly.

If a very fast colour is desired, then the yarn may be after-treated, with 1/2% Tannic acid or 1 1/2% Myrabolam. This may be done in the dye-bath, provided the colour is completely exhausted or in a fresh bath at about 175° F. (80° C.). The shade turns a little more bluish but the fastness to washing and light is considerably increased.

Dyeing Loose Cotton.

Loose cotton is mordanted exactly as described for cotton yarn. The dye-bath is charged with acetic acid, alum and colour, then brought to about 160° F. (70° C.). The mordanted cotton is entered quickly, worked well and the temperature raised around gradually to boil.

Piece Goods.

Piece goods are dyed with Naphtindone exactly like yarn, either in the open vat with winch or better in a jigger or padding machine.

Chapter VIII.

Immedial Colours.

Immedial Colours.*)

Dissolving and Dyeing.

The Immedial Colours are best dissolved in wooden or iron vessels by pouring over them hot water containing the sodium sulphide required for dyeing. Vessels or fittings made of copper or brass must be not be used. The nesessary metallic parts may be made of iron or lead. Calcareous water should be treated as for Diamine Colours (page 39).

N.B. The Immedial Colours must be kept in a dry room protected against moisture. The cask should be well covered, each time colour has been taken on.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing	Dyeing Directions for loose Cotton Yarns and Fabrics. (The percentages stated are to be understood on the dry weight of the cotton.)
Immedial Black **V extra** **F F extra** **G extra** **N B** **N G** **N F** **N R** **N R T** **Immedial Brilliant Black B**	For 1 part dyestuff 3/4 part sodium sulphide crystals	For Grey: For Black: Starting bath: Dyestuff 1 8 % 15 – 25 % Sodium sulphide crystals 2 6 % 10 18 % Soda ash 4½ -8 oz 4½ 8 oz Common salt or desicc. Glauber's salt 0 1 lb p. 10 galls. liquor 1 — 3 lbs p. 10 galls. liquor For subsequent lots: Dyestuff 0,7 5 % 10 25 % Sodium sulphide crystals 1 —3,5 % 7 11 % Soda ash 0,2 — 0,5 % 0,2 0,5 % Common salt or desicc. Glauber's salt 0 —2 % 0 — 5 %

Dye for one hour near boiling point, squeeze off, and rinse immediately. Loose cotton is allowed to drain off or whizzed, and then rinsed.

If the goods are not given an alkaline softening, 5 8 oz acetate or formate of soda per 10 gallons of water are added to the final rinsing bath.

---

*) Instead of the quantities of sodium sulphide crystals indicated in the following tables, half the quantity of sodium sulphide conc. may be used.

Dissolving and Dyeing Immedial Colours.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing	Dyeing Directions for loose Cotton Yarns and Fabrics. (The percentages stated are to be understood on the dry weight of the cotton.)		
	For 1 part dyestuff		For Grey:	For Black:
Immedial Black **BF conc.** **BFB conc.** **BFG conc** **BFN conc.** **JBR conc.** **NNG conc.** **NBB conc.** **NLA conc.** **NLJ conc.** **NLN conc.** **NN conc.** **NNR conc.** **NNZ conc.*)** **Immedial Brilliant Black** **5BV conc.** **6BG conc.** **8BG conc.**	1 part sodium sulphide crystals	Starting bath:		
		Dyestuff	0,5—4,5 %	8—14 %
		Sodium sulphide crystals	1,5—5 %	8—14 %
		Soda ash	$4^{1}/_{2}$—8 oz p. 10 galls. liquor	$4^{1}/_{2}$—8 oz p. 10 galls. liquor
		Common salt or desicc.		
		Glauber's salt	0—1 lb p. 10 galls. liquor	1—3 lbs p. 10 galls. liquor
		For subsequent lots:		
		Dyestuff	0,4—3 %	5—9 %
		Sodium sulphide crystals	1—3,5 %	5—9 %
		Soda ash	0,2—0,5 %	0,2—0,5 %
		Common salt or desicc.		
		Glauber's salt	0—2 %	0—5 %
			For Grey.	For Black:
Immedial Carbon B **R** **JHJ** **BL** **Immedial Brilliant Carbon F, FG**	$1^{1}/_{4}$—2 part sodium sulphide crystals	Starting bath:		
		Dyestuff	0,4—3 %	5—9 %
		Sodium sulphide crystals	1,5—6 %	10—16 %
		Soda ash	$4^{1}/_{2}$—8 oz p. 10 galls. liquor	$4^{1}/_{2}$—8 oz p. 10 galls. liquor
		Common salt or desicc.		
		Glauber's salt	0—1 lb p. 10 galls. liquor	1—3 lbs p. 10 galls. liquor
		For subsequent lots:		
		Dyestuff	0,25—1,5 %	3—6 %
		Sodium sulphide crystals	0,7—3 %	6—10 %
		Soda ash	0,2—0,5 %	0,2—0,5 %
		Common salt or desicc.		
		Glauber's salt	0—2 %	0—5 %

Dye as indicated on the previous page (page 105), and likewise aftertreat with acetate or formate of soda.

---

*) In some special cases, e. g. in machine-dyeing, or in the dyeing of piece-goods, $1^{1}/_{4}$ to $1^{1}/_{2}$ parts of sodium sulphide crystals are used for 1 part of Immedial Black NNZ conc.

Dissolving and Dyeing Immedial Colours.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing
	For 1 part dyestuff
Immedial Yellow GG, D	1 part sodium sulphide crystals
Immedial Orange C	
Immedial Bronze A	
Immedial Yellow Brown EN	
Immedial Khaki G, D	
Immedial Cutch G, O, R, BG, BGG	
Immedial Brown B, BR, RR, W conc.	
Immedial Dark Brown D conc.	
Immedial Dark Brown A	
Immedial Maroon B conc.	
Immedial Bordeaux G conc., GF conc.	
Immedial Prune S	
Immedial Violet C	1/2—1 part sodium sulphide crystals
Immedial Purple C	
Immedial Yellow Olive G	1 part sodium sulphide crystals
Immedial Olive 3G, GG, B	
Immedial Brilliant Green G extra	
Immedial Green GG extra BB extra GGX conc. BBX conc. BBXN conc.	
Immedial Deep Green G	
Immedial Dark Green B	

Dyeing Directions for loose Cotton Yarns and Fabrics.

(The percentages stated are to be understood on the dry weight of the cotton.)

	Pale and medium shades:		Deep shades:	
Starting bath:				
Dyestuff	2 —8 %		8 —20 %	
Sodium sulphide crystals	5 — 8 %		8 — 20 %	
Soda ash	4 1/2—8 oz	p. 10 galls. liquor	4 1/2— 8 oz	p. 10 galls. liquor
Common salt or desicc. Glauber's salt	6 —1 lb		1 — 2 lbs	
For subsequent lots:				
Dyestuff	1,5 —5 %		5 —14 %	
Sodium sulphide crystals	1,5 — 5 %		5 — 14 %	
Soda ash	0,2 —0,5 %		0,2 — 0,5 %	
Common salt or desicc. Glauber's salt	0 —2 %		0 — 5 %	

Dye for about one hour near boiling temperature, squeeze off, and rinse at once. Loose Cotton is drained and then rinsed.

Immedial Yellow GG, is best dyed without the addition of any soda or Glauber's salt.

With *Immedial Bordeaux G conc., GF conc., Immedial Maroon B conc.* and *Immedial Prune S,* brighter shades are obtained by dyeing at a lower temperature 120—140 deg. F (50—60° C.) and this effect is still enhanced by adding a little glue about one-fifth of the weight of dyestuff. For these dyestuffs a little acetic acid is added to the last rinsing bath.

Immedial Violet C and *Immedial Purple C* are best dyed at a temperature of only 160—175 deg. F. (60—70° C.) without the addition of any soda or Glauber's salt

Brighter tones are obtained with *Immedial Dark Green B* if the dyeings are exposed to the air for some time after rinsing, or brightened hot with soap and soda.

Dissolving and Dyeing Immedial Colours.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing	Dyeing Directions for loose Cotton Yarns and Fabrics. (The percentages stated are to be understood on the dry weight of the cotton.)
	To 1 part dyestuff	Pale and medium shades: Deep shades:
Immedial Direct Blue B, JB, R, OD **Immedial Dark Blue CRV, J**	1 part sodium sulphide crystals	Starting bath: Immedial Direct Blue B, JB, R, OD 2 – 8 % 8 - 20 % Sodium sulphide crystals 5 8 % 8 —20 % Soda ash 4½ – 8 oz p. 10 galls. liquor 4½ 8 oz p. 10 galls. liquor Common salt or desicc. Glauber's salt 1 —0 lb 1 — 2 lbs For subsequent lots: Immedial Direct Blue B, JB, R, OD 1,5 5 % 5 --14 % Sodium sulphide crystals 1,5 -5 % 5 14 % Soda ash 0,2 —0,5 % 0,2 0,5 % Common salt or desicc. Glauber's salt 0 2 % 0 5 % *Immedial Direct Blue* and *Immedial Dark Blue* are dyed for one hour near boiling temperature, the goods are thereupon squeezed off and rinsed immediately. Loose cotton is allowed to drain, and then rinsed. Brighter tones are obtained with dyeings of *Immedial Direct Blue,* if they are exposed to the air for some time after the rinsing, or brightened hot with soap and soda.
Immedial Direct Blue **B extra conc.** **BB extra conc.** **4B extra conc.** **JB extra conc.** **R extra conc.**	2 parts sodium sulphide crystals	The ***concentrated Immedial Direct Blues*** are dyed like the single strength brands of Immedial Direct Blues, except that, in accordance with the greater concentration, only half the quantity of dyestuff is required for producing the same depth of shade, the quantities of other ingredients remaining the same
Immedial Indogene **B conc.** **GCL conc.**	1½ – 2 parts sodium sulphide crystals	*Immedial Indogene* is dyed like Immedial Direct Blue B, but a little more sodium sulphide crystals (1½ to 2 parts as against 1 of dyestuff) is required. *Immedial Indogene GCL conc.* dyed at a lower temperature 105 140 deg. F. (40 – 60° C.) yields brighter shades of Blue.

Dissolving and Dyeing Immedial Colours.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing	Dyeing Directions for loose Cotton Yarns and Fabrics (The percentages stated are to be understood on the dry weight of the cotton.)
Immedial Indone **R conc.** **RR conc.** **RG conc.** **RB conc.** **3B conc.** **B conc.** **BBF conc.** **BF conc.** **BN conc.** **JBN conc.** Immedial Indone 3B conc., B conc., BBF conc. and BF conc. are dissolved by pouring over 1 lb of dyestuff the boiling solution of 1 lb sodium sulphide crystals in 1 gall. water and bringing to solution by stirring without any further boiling. The remainder of the sodium sulphide is added straight to the dye liquor.	For 1 part dyestuff 2 parts sodium sulphide crystals	Pale and medium shades: Deep shades: Starting bath. Dyestuff 2 10 % 10 16 % Sodium sulphide crystals 5 - 20 % 20 32 % Glucose 2 —10 % 10 --16 % Soda ash 4½— 8 oz p. 10 gals. liquor 4½ 8 oz p. 10 gals. liquor Common salt or desicc. Glauber's salt 0 1 lb p. 10 gals. liquor 1 2 lb p. 10 gals. liquor For subsequent lots Dyestuff 1,5 6 % 6 10 % Sodium sulphide crystals 3 12 % 12 —20 % Glucose 0,2 — 0,5 % 0,2 — 0,5 % Soda ash 0,2 0,5 % 0,2 - 0,5 % Common salt or desicc. Glauber's salt 0 - 2 % 0 — 5 %

Loose cotton is dyed first boiling for 10—15 minutes and then without steam. When dyeing is completed, it is thrown out into heaps and allowed to drain off, and after lying for some time in order to oxidize it is rinsed.

Cotton yarn is dyed in pale shades at 85 -105 deg. F., (30-40° C.) in dark shades at 120-160 deg. F. (50-70° C.) with the *JBN conc.*, *BN conc.* and *RB conc.* brands at 175-195 deg. F. (80-90° C.) squeezed, off, wrung off, exposed to the air, for some time and rinsed.

Piece-goods are dyed hot, squeezed off, passed over guiding rollers in order to oxidize in the air, and rinsed.

Dissolving and Dyeing Immedial Colours.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing	Dyeing Directions for loose Cotton Yarns and Fabrics. (The percentages stated are to be understood on the dry weight of the cotton.)	
	For 1 part dyestuff	Pale and medium shades:	Deep shades:
		Starting bath:	
Immedial Blue C **CB** **CR**	1 part sodium sulphide crystals	Immedial Blue C, CB, CR 5 —10 %	10 —20 %
		Sodium sulphide crystals 6 —10 %	10 —20 %
		Caustic soda lye of 77° Tw. 1½— 3 oz p. 10 galls. liquor	1½— 3 oz p. 10 gall liquor
		Common salt or desicc. Glauber's salt 3 oz — 1 lb p. 10 galls. liquor	1 — 3 lbs p. 10 gall liquor
		For subsequent lots:	
Immedial Blue **C extra conc.** **CB extra conc.** **CBL extra conc.** **CR extra conc.**	2 parts sodium sulphide crystals	Immedial Blue C, CB, CR 3 — 6 %	6 —12 %
		Sodium sulphide crystals 3 — 6 %	6 —12 %
Immedial New Blue G conc.	1½—2 parts sodium sulphide crystals	Caustic soda lye of 77° Tw 0,1 - 0,2 %	0,1 - 0,2 %
		Common salt or desicc. Glauber's salt 0 2 %	0 — 5 %

Immedial Blue is dyed for about one hour near boiling temperature.

Loose cotton is then thrown out and whizzed, and the shade developed by smothering for several hours.

Cotton yarn is squeezed off, wrung off, and developed by smothering or steaming.

Piece-goods are squeezed off and developed by smothering or steaming.

The cotton is always rinsed hot after developing.

For more covered shades, *soda ash* (4½–8 oz per 10 gallons liquor) may be used in place of *caustic soda lye*.

The *concentrated Immedial Blues* are dyed like the ordinary strength brands except that for the same depth of shade only half the quantity of dyestuff is required, the other additions remaining the same.

Immedial New Blue G conc. is dyed and developed in the same way as the Immedial Blues, except that one-and-a-half times to double the weight of sodium sulphide crystals as of dyestuff is necessary.

Immedial New Blue G conc. may likewise be developed by means of an aftertreatment with bichromate of potash and sulphate of copper, yielding darker shades by this method. The cotton is immediately rinsed and aftertreated after dyeing.

For further particulars regarding the developing of Immedial Blue see pages 114, 118–119 and 130.

Dissolving and Dyeing Immedial Colours.

Name of the Colour	Quantity of Sodium Sulphide requisite for dissolving and dyeing	Dyeing Directions for loose Cotton Yarns and Fabrics. (The percentages stated are to be understood on the dry weight of the cotton.)		
	For 1 part dyestuff		Pale and medium shades:	Deep shades:
		Starting bath:		
Immedial Sky Blue Paste	1/2 part sodium sulphide crystals	Dyestuff (paste)	2 - 10 %	10 — 20 %
		Sodium sulphide crystals	2 - 6 %	6 — 10 %
		Soda ash	4 1/2 — 8 oz	4 1/2 — 8 oz
Immedial Sky Blue powder conc.	1 part sodium sulphide crystals	Turkey-red oil	1 1/2 oz p 10 galls. liquor	1 1/2 oz p. 10 galls liquor
		Common salt or desicc. Glauber's salt	1 - 2 lb p 10 galls. liquor	0 — 5 lbs p. 10 galls liquor
		For subsequent lots:		
In order to dissolve Immedial Sky Blue, a boiling hot solution of the sodium sulphide and soda requisite for the dyeing is poured over it; while a short boiling will be helpful in dissolving, long boiling should be avoided.		Dyestuff (paste)	1,2 — 6 %	6 — 10 %
		Sodium sulphide crystals	0,6 - 3 %	3 — 5 %
		Soda ash	0,2 — 0,5 %	0,2 0,5 %
		Turkey-red oil	0,5 %	0,5 %
		Common salt or desicc. Glauber's salt	0 — 5 %	5 — 10 %

Of *Immedial Sky Blue powder conc.*, which is double the strength of the paste product, only half the quantity is required for producing the same depth of shade; the other ingredients remain the same as for the paste product.

Immedial Sky Blue is dyed for 1/4 – 1/2 hour at 85 – 95 deg. F. (30 – 35° C.).

Loose cotton after dyeing is thrown out, then left lying exposed to the air in order to oxidize, and rinsed.

Cotton yarn is squeezed off, wrung off evenly, hung up, and rinsed.

Piece-goods are squeezed off, passed over several guiding rollers for oxidation in the air, and rinsed.

Aftertreatment of the. Immedial Colours.

I. Aftertreatment with Metallic Salts.

a) Aftertreatment with Chromium Salts.

Aftertreatment with Metallic Salts.

3 % bichromate of potash and 3—5 % acetic acid, or 2—3 % bichromate of potash, 1,5—2 % chrome-alum and 3—5 % acetic acid may be used

b) Aftertreatment with Bichromate of Potash and Sulphate of Copper.

1,5—2 % bichromate of potash, 1,5—2 % sulphate of copper and 3—5 % acetic acid as a rule are used.

The previously dyed cotton after a thorough rinsing is aftertreated for 20—30 minutes at boiling temperature, and then rinsed thoroughly once more.

II. Aftertreatment with Acetate or Formate of Soda.

Aftertreatment with Acetate or Formate of Soda.

Such aftertreatment is applied mainly for Blacks dyed with Immedial Colours when the usual alkaline brightening or softening is dispensed with. This kind of aftertreatment is especially necessary for all kinds of blacks which have been subjected to an acid aftertreatment, and is of the greatest importance for cotton warps in union goods, both immediately after the dyeing of the cotton and after the subsequent dyeing of the wool with Acid Colours.

The quantities required are 5—8 oz acetate of soda or 3—4½ oz formate of soda per 10 gallons, and these salts are generally added directly to the last rinsing bath. In the case of yarns, warps and fabrics which are sized, or finished after the dyeing, these salts may be added to the size or the finish.

Shading Immedial Colours with Diamine or Basic Colours.

Shading with Diamine or Basic Colour.

Some of the Diamine or Basic Colours may be added to Immedial Colour baths for shading purposes.

Any quantity desired may be used of

Diamine Fast Yellow B
Diamine Orange B;

of the following, only very small quantities may be used for brightening;

Diamine Red 4B
Diamine Brilliant Scarlet S
Diamine Violet Red
Oxy Diamine Orange G, R
Safranine, all brands
Tannin Heliotrope

The afore-mentioned products have the property of dyeing well and evenly in a bath containing sodium sulphide.

Dyeing of Immedial Colours in a cold or lukewarm Bath.

Dyeing in a cold or lukewarm Bath.

Any of the Immedial Colour may likewise be dyed in a lukewarm bath, the best suited for this purpose however are the following brands:

- Immedial Indone 3B conc.
  - BBF conc.
  - BF
  - R conc.
  - RG conc.
  - RR conc.
  - JBN conc.
- Immedial Indogene GCL conc.
- Immedial Dark Blue J
- Immedial Green GG extra
- Immdial Deep Green G
- Immedial Olive 3G
- Immedial Yellow Olive G
- Immedial Cutch O, R
- Immedial Brown BR
- Immedial Maroon B conc.
- Immedial Bordeaux G conc.,
  - GF conc.
- Immedial Black V extra
  - FF extra
  - NNG conc.
  - NBB conc.
- Immedial Brilliant Black
  - 5BV conc.
- Immedial Carbon B, BL
- Immedial Brilliant Carbon F, FG

Dye cold according to the general directions, except that in the case of deep shades the starting bath should be charged with one half more of the weights of dyestuff and sodium sulphide stated.

Immedial Indone, Immedial Dark Blue and *Immedial Indogene GCL conc.* yield somewhat more covered shades and exhaust better in the bath when about an equal weight of *Immedial Intensifier C* as of dyestuff is added.

Immedial Intensifier C is best added in powder form to the dyebath shortly before entering the goods and stirred up well in the bath.

Immedial Colours on Loose Cotton.

Immedial Colours on Loose Cotton.

Regarding the charging of the dyebaths see pages 105—111.

The Immedial Colours are dyed, like the Diamine Colours, in vats, kettles or barks, which must however not contain any copper or brass fittings coming into contact with the liquor.

The *heating of the liquor* is best done with indirect steam, steam pipes made of iron or lead being used.

In *dyeing*, the liquor which should be as concentrated as possible is first boiled up with all the ingredients; the dry, previously opened cotton is then entered into the boiling bath, and worked thoroughly for 10 to 15 minutes at the boil. The dye vessel is then covered, the cotton being kept immersed in the liquor as far as possible and dyeing being continued for another $^1/_2$ to $^3/_4$ hour in the hot bath, without steam After dyeing, the cotton is thrown out on to a wooden lattice frame or into baskets so as to allow the adhering liquor to drain back into the dyebath, and then rinsed.

Immedial Colours may also be dyed in a dye vat as per sketch 19 on page 19 which contains an inner kettle by means of which the loose cotton may be lifted out of the liquor in a simple manner.

Immedial Blue and *Immedial New Blue* are dyed somewhat differently in so far as the cotton is hydro-extracted after dyeing but *not rinsed:* while still warm it is made up into heaps or thrown into baskets and left smothering for some hours in a warm room in order to develop the blue. After the developing, the cotton is rinsed hot.

For matching Immedial Blue shades, the undeveloped shade is made use of, a small pattern being taken as a guide, rinsed in cold water, passed through dilute acetic acid, or a weak solution of alum, and kept after drying without rinsing again. By this treatmend the shade is permanently fixed, and as steaming always has the same effect upon the shade, it is sufficient to match the undeveloped dyes.

Bottoming with Immedial Colours, and Topping with Basic Colours.

The bottoming is carried out with Immedial Colours as described above, the cotton being then rinsed. For the topping with Basic Colours, the cotton is then treated in a cold bath charged with the basic dyestuff and some acetic acid, which may be heated towards the end of the operation to about 120 deg. F. This treatment usually takes place in the washing machine.

Bottoming with Immedial Colours, and Topping with One-dip Aniline Black.

About $^1/_2$ to $^1/_3$ the quantity of Immedial Black as used for Black dyeing alone is required for bottoming.

For topping purposes, the cold bath, which should be kept as short as possible (a volume of liquor not more than 10 to 15 times the weight of the cotton), is charged with

about 4 $^0/_0$ aniline salt.
6—7 $^0/_0$ hydrochloric acid of 32 deg. Tw.,
3 $^0/_0$ sulphuric acid of 168 deg. Tw., to which
are added, before entering the material,
3 $^0/_0$ sulphate of copper and
4 $^0/_0$ bichromate of potash.

Dye for 1 to $1^1/_2$ hour in the cold bath, then heat during the course of about $^1/_2$ hour to 120–140 deg. F. (50–60° C.) rinse well, and soap, if necessary hot.

Should the black obtained show up too much on the green side, some soda is added to the soap bath; if on the other hand it is too reddish, the goods after soaping and rinsing, are soured off with 1 to 2 $^0/_0$ acetic acid.

5–8 oz acetate or formate of soda per 10 gallons water should be added to the last rinsing bath, unless the cotton is finally soaped or otherwise treated alkaline.

Softening Loose Cotton.

This manipulation has for its object to render the cotton supple, and is resorted to especially with material to be used for the spinning of carded yarn.

The softening is prepared by boiling up together in a cask:

3 parts of oleïne,
1 part soap and
$^1/_2$ part ammonia liquor

and adding a few pints to the liquor in which the cotton is to be treated.

Immedial Colours on Cotton Yarn.

The quantities required for dyeing are the same as stated on pages 105—111.

Immedial Colours on Cotton Yarn.

The Immedial Colours are dyed in vats or barks made of wood or iron, the fittings of which, so far as they come into contact with the dye liquor, must not be made of copper or brass. It is recommended to heat the baths with indirect steam.

The dyeing is generally carried out in a boiling bath for $^{3}/_{4}$ to 1 hour, best on bent iron pipes (see below); after dyeing, the hanks, in order to ensure good levelness, are squeezed off thoroughly or wrung off evenly, and then in most instances rinsed at once.

If high demands with regard to levelness of the colours be made, the use of bent iron pipes is recommended.

For the required purpose, gas pipes of $^{3}/_{4}$—1 inch diameter are bent to this shape ‾L___Γ‾, fitted exactly to the inner width of the vessel, and wrapped with strips of cotton cloth round those parts on which the yarn rests.

Instead of wrapping the rods with cloth, they may, in order to prevent them from rusting, be rubbed every night with a rag dipped into mineral oil, or washed each time after use in water containing some soda and dried at once; the rods are best stored in a drying room or any other warm place.

The method of working with these rods is illustrated by the following sketch 34.

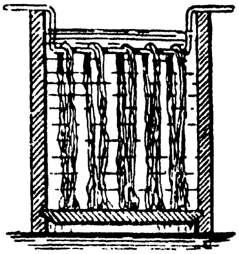


Fig. 34.

In most cases straight sticks may be used; before being taken out, the yarn must be turned quickly two or three times, stick by stick, and then well sqeezed. The usual lifting and draining the hanks must in this case be studiously avoided.

In order to control the amount of salts contained in the dye-baths which are in constant use, gravity tests should be frequently made with a hydrometer. For dyeing blacks the cold liquor may stand at 8—10° Tw., but for Immedial Blue and the other colours it should not exceed 4 or $4^1/_2$° Tw. Should the gravity be higher, the next few batches may be dyed withoute the addition of salt.

Glauber's salt may be used in place of common salt, with the same result, 10 parts of common salt being equal to 12 parts of desiccated Glauber's salt or 24 parts of crystallised Glauber's salt.

Immedial Indone is mostly dyed at a somewhat lower temperature than Immedial Colours generally; after dyeing, the yarn is squeezed off thoroughly, wrung off as evenly as possible, hung up for $^1/_2$ to 1 hour, and only then rinsed.

In dyeing *Immedial Blue* and *Immedial New Blue*, the hanks are likewise squeezed off evenly after dyeing, but *not rinsed* and then developed by smothering or by steaming

For developing by *smothering*, the dyed hanks are wrung off well and placed still warm into a basket or box; they are then covered up well and brought into a warm room for some hours, after which they are rinsed hot.

The developing by steaming is done either in an apparatus as mentioned on page 28 (fig. 32 on page 29) or else in an ordinary wooden bark serving as steam-chest as per sketch 35 (on page 119).

The bark should be deeper than usual, about 4 feet deep which may be effected by heightening the walls with wooden boards. A cover, a double bottom, an air-injector and heating arrangements are also provided.

The cover which is lined with cloth fastened on to a wooden lattice frame, should best have the form of a slightly overlapping roof.

The hanks are suspended in the chest on ordinary sticks similarly as for dyeing. The cover having been adjusted, both steam and air are blown in. After steaming for $^1/_2$ or $^3/_4$ hour, the blue will be completely developed. The yarns are then removed and rinsed in warm water and, if so desired, soaped hot or topped. The steaming may be interrupted at any time,

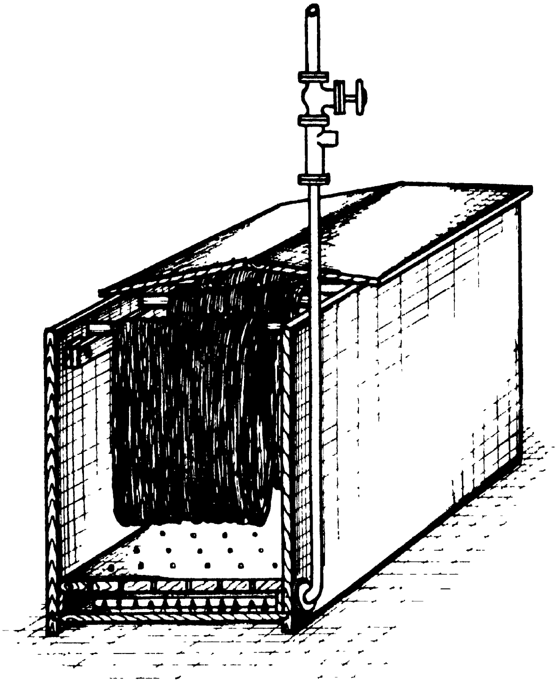


Fig. 35.

and a hank taken out for sampling in order to ascertain, whether the blue be satisfactorily developed. It is not advisable to unduly extend the steaming; although the blue thereby increases in brilliancy, it somewhat loses in fastness to washing.

An ordinary dye-vat will also suit the purpose, it must be provided with heating-arrangement, with a double bottom, air-injector and lid. The yarns are suspended in this bark in such a way as to be clear of the perforated bottom by at least 4 inches. It is well to heat the steam-chest by a closed steam-coil provided for this purpose, before charging it with the yarn, and to protect the latter by a cover of dry cloth against condensed steam causing spots.

For matching Immedial Blue shades, the undeveloped shade is made use of, a small pattern being taken as a guide, rinsed in cold water, passed through dilute acetic acid, or a weak solution of alum, and kept after drying without rinsing again. By this treatment the shade is permanently fixed, and as steaming always has the same effect upon the shade, it is sufficient to match the undeveloped dyes.

Bottoming with Immedial Colours, and Topping with Basic Colours.

Dyeings produced with Immedial Colours are topped by working the well rinsed yarn for some minutes in a cold bath containing 3—5 % acetic acid, then adding the solution of the basic dyestuff in several portions, and heating the bath finally to about 140—175 deg. F. (60—80° C.).

Immedial Colours may be topped in the soap bath if only very small quantities of Basic Colours are required.

Bottoming with Immedial Colours, and Topping with One dip Aniline Black.

The dyeing and topping is carried out exactly as described for loose cotton.

Bottoming with Immedial Colours, and Topping with Indigo.

Of the *Immedial Colours, Immedial Black V extra, Immedial Direckt Blue* and *Immedial Blue* are employed principally; for very deep and dense Blues, *Immedial Brilliant Black 5 B V conc.* is used either alone or in combination with any of the blues mentioned above.

The yarn is dyed as customary, then rinsed, and topped at will with Indigo. It is unnecessary to specially develop *Immedial Blue* if it is to be topped subsequently with Indigo.

Any of the different kinds of Indigo vats are equally suitable for topping purposes.

Immedial Colours on Piece-goods.

Immedial Colours on Piece-Goods.

Piece-goods may be dyed with Immedial Colours in the jigger, in the padding machine, or in the continuous machine.

A. Dyeing in the Jigger.

Dyeing in the Jigger.

The jiggers should for this purpose be provided with squeezing rollers such as shown on pages 24 and 25 (sketches 25 and 26).

The dyebath is charged according to instructions given on pages 105—111 except, however, that *the starting bath should be charged with slightly increased quantities of dyestuff when dyeing small batches, and with slightly reduced quantities when dyeing large batches.*

We give the following examples from practice.

Black with Immedial Black.

5 pieces thin sateen, 45 lbs in weight, 22 gallons liquor:

	Starting bath:	For subsequent lots
Immedial Black NNG conc.	$7^{1}/_{4}$ lbs	$2^{7}/_{8}$ lbs
Sodium sulphide crystals	$7^{1}/_{4}$ lbs	$2^{7}/_{8}$ lbs
Soda ash	1 lb	0,1 – 0,2 lb
Common salt or desiccated Glauber's salt	$6^{1}/_{2}$ lbs	1 lb

5 pieces of moleskin, 330 lbs dry weight, 45 gallons liquor:

	Starting bath:	For subsequent lots·
Immedial Black NNG conc.	30 lbs	21 lbs
Sodium sulphide crystals	30 lbs	21 lbs
Soda ash	2 lbs	$^{1}/_{2}$ lb
Common salt or desiccated Glauber's salt	12 lbs	2 lbs

Give six to eight passages at boiling temperature, adding one-half of the ingredients at the beginning and the other half after the first passage. After the last passage the goods are squeezed off very thoroughly and run straight into the rinsing jigger where they are rinsed.

The goods to be dyed must be beamed as evenly as possible; attention must likewise be paid to the goods running straight throughout the dyeing process. When dyeing goods that are difficult to dye level, some more sodium sulphide should be added to the dyebath before the last passage and the bath be boiled up once more.

After having passed the rinsing jigger, the goods are washed in a washing machine or in the jigger until the wash water is perfectly clear. Some 5 to 8 oz acetate or formate of soda per 10 gallons liquor are added to the last rinsing bath, the goods being then dried without any further rinsing.

Blue dyed with Immedial Direct Blue or Immedial Indogene.

5 pieces of twill, 45 lbs in weight, 22 gallons liquor:

	Starting bath:	Subsequent lots according to depth of shade:
Immedial Direct Blue B extra conc.	1 $3^3/_4$ lbs	$^2/_3$ – $2^1/_4$ lbs
Sodium sulphide crystals	3 - $7^1/_2$ lbs	$1^1/_3$ – $4^1/_2$ lbs
Soda ash	0,6 1 lb	0,1 – 0,2 lbs
Common salt or desiccated Glauber's salt	1 - 4 lbs	0,2 - 0,9 lb

5 pieces moleskin, 330 lbs in weight, 45 gallons liquor:

	Starting bath:	Subsequent lots: according to depth of shade·
Immedial Direct Blue B extra conc.	5,1 - $19^1/_2$ lbs	5 – $16^1/_2$ lbs
Sodium sulphide crystals	15 – 39 lbs	10 – 33 lbs
Soda ash	1,3 – 2 lbs	0,4 – 1 lb
Common salt or desiccated Glauber's salt	2 – 9 lbs	0,4 – 2 lbs

Dye with 4 to 8 passagos at boiling temperature. After the last passage, squeeze off thoroughly, and wash at once in the rinsing jigger.

Blue dyed with Immedial Indone.

Immedial Indone is dyed in the same kind of jigger, provided with squeezing rollers, as is used for the other Immedial Colours. For oxidising purposes, the goods are given an air passage for 12 to 24 yards over some guiding rollers after the squeezing off and before the rinsing as shown on page 25.

5 pieces sateen, 44 lbs in weight, 22 gallons liquor:

	Starting bath:	subsequent lots:
	according to	depth of shade:
Immedial Indone R conc.	$1^{3}/_{4}$ — 7 lbs	$^{7}/_{8}$ — $3^{1}/_{2}$ lbs
Sodium sulphide crystals	$5^{1}/_{4}$—14 lbs	$1^{3}/_{4}$ — 7 lbs
Glucose	$1^{3}/_{4}$ — 7 lbs	0,2 — 0,9 lb
Turkey-red oil	$^{2}/_{3}$ — 1 lb	0,1 — 0,2 lb
Soda ash	$^{2}/_{3}$ — 1 lb	0,1 — 0,2 lb
Common salt or desiccated Glauber's salt	1 — 4 lbs	0,2 — 1 lb

5 pieces moleskin, 330 lbs in weight, 45 gallons liquor:

	Starting bath:	Subsequent lots:
	according to	depth of shade:
Immedial Indone R conc.	$8^{3}/_{8}$—33 lbs	$6^{1}/_{2}$—26 lbs
Sodium sulphide crystals	25 —66 lbs	13 —52 lbs
Glucose	$8^{3}/_{8}$ 33 lbs	1 — 3 lbs
Turkey-red oil	$1^{1}/_{4}$— 2 lbs	0,2 — 0,4 lbs
Soda ash	$1^{1}/_{4}$- 2 lbs	0,2 - 0,4 lb
Common salt or desiccated Glauber's salt	2 — 9 lbs	0,2 — 0,4 lbs

Dye at 120—140 deg. F. with 4 to 8 passages. After the last passage, squeeze off, give an air passage, and enter into the rinsing jigger at once.

Blue dyed with Immedial Blue or Immedial New Blue.

5 pieces sateen, 44 lbs in weight, 22 gallons liquor:

	Starting bath:	Subsequent lots:
	according to	depth of shade:
Immedial Blue CR extra conc.	$1^{1}/_{3}$ — $4^{7}/_{8}$ lbs	$^{7}/_{8}$ — $2^{5}/_{8}$ lbs
Sodium sulphide crystals	4 — $9^{3}/_{4}$ lbs	$1^{3}/_{4}$ — $5^{1}/_{4}$ lbs
Caustic soda lye of 77 deg. Tw.	0,3 — 0,6 lbs	0,04 — 0,1 lbs
Common salt or desiccated Glauber's salt	1 — $4^{1}/_{2}$ lbs	0,2 — 1 lb

5 pieces moleskin, 330 lbs in weight, 45 gallons liquor:

	Starting bath:	Subsequent lots:
	according to	depth of shade
Immedial Blue CR extra conc.	$8^{1}/_{2}$—24 lbs	$6^{1}/_{2}$ —20 lbs
Sodium sulphide crystals	22 —48 lbs	13 - 40 lbs
Caustic soda lye of 77 deg. Tw.	0,6 — $1^{1}/_{4}$ lb	0,2 — 0,4 lb
Common salt or desiccated Glauber's salt	2 9 lbs	0,4 — 2 lbs

Dye in 4 to 8 passages at boiling temperature. The goods are not rinsed after dyeing, but thoroughly squeezed off and then developed by smothering or steaming with the admission of air, as described on page 130, they are then rinsed hot.

Dyeing the other Immedial Colours.

Immedial Direct Blue (single strength brands), Immedial Brown, Immedial Dark Brown, Immedial Cutch, Immedial Prune, Immedial Maroon, Immedial Bordeaux, Immedial Violet, Immedial Purple, Immedial Olive, Immedial Green, Immedial Brilliant Green, Immedial Dark Green, Immedial Deep Green, Immedial Orange, Immedial Yellow are dyed according to the example stated for Immedial Direct Blue B extra conc, equal weights of sodium sulphide crystals as of dyestuff being however used; see page 107

Combinations of Immedial Direct Blue with Immedial Indone are dyed like Immedial Indone, i. e. with a subsequent air passage, whereas all other combinations are simply dyed like Immedial Direct Blue or Immedial Black and are rinsed immediately after the squeezing off.

Pale Mode Shades

are dyed in the same manner as stated above, except with a slightly increased quantity of sodium sulphide and very little or no Glauber's salt

Charge the bath approximately as follows:

1—6 % of the various dyestuffs
2—8 % sodium sulphide crystals } calculated on the weight of the goods to be dyed.
1—5 % soda ash

Add to the jigger, first the soda and then the dyestuffs dissolved in sodium sulphide, and dye at boiling temperature with 4—6 passages. In the case of deeper shades, add besides 5—10 % Glauber's salt after the second passage; when dyeing goods that are difficult to dye through, it is advantageous to add to the bath $^1/_2$—1 % Turkey-red oil or Universal oil, calculated on the weight of the goods.

For shading purposes, certain Diamine Colours may be added simultaneously with the Immedial Colours (see p. 112). The dyeings may besides be subsequently topped at will with Basic Colours.

The dyeings produced with Immedial Colours are without exception exceedingly fast to washing and acids. Their fastness to light is likewise most excellent, but this may be enhanced still more especially in the case of pale shades, by an aftertreatment with sulphate of copper and bichromate of potash.

The goods are aftertreated for about ½ hour at 140—175 deg. F. (60—80° C.) with

1 —2 % sulphate of copper	calculated on the weight of the goods
½—1 % bichromate of potash	
3 —4 % acetic acid	

and finally rinsed.

The following are some recipes for the production of current mode shades.

Military-Grey.

5 pieces of twill, weighing about 120 lbs, in 45 gallons liquor

Charge the jigger with

10 oz soda ash
2 lbs sodium sulphide crystals,

giving the goods, previously well freed from size, 2 passages at boiling temperature; then add in two portions

1 lb 3¼ oz Immedial Dark Brown A and
1 lb 7¼ oz Immedial Dark Green B, dissolved with
2 lbs 10½ oz sodium sulphide crystals

and complete the dyeing at boiling temperature with 10—12 passages.

After the last passage, the goods are squeezed off thoroughly, rinsed immediately in a second jigger ready to hand, and then aftertreated with bichromate of potash and sulphate of copper.

Khaki.

6 pieces of twill, weighing 118 lbs, in 45 gallons water.

The goods previously freed from size are boiled out with two passages in a bath charged with

10 oz soda ash
2 lbs sodium sulphide crystals

and then dyed with the addition of

for pale Khaki:	for deep Khaki:
2 lbs 13 oz Immedial Khaki G	3 lbs 5 oz Immedial Khaki D
2 lbs 13 oz sodium sulphide crystals	3 lbs 5 oz sodium sulphide crystals

in 10—12 passages, squeezed off and rinsed immediately with a plentiful supply of water.

The aftertreatment is carried out in a hot bath with

1 lb 10 oz sulphate of copper
1 lb 10 oz bichromate of potash and
2½ pints acetic acid

in 3—4 passages, finally rinsing the goods again.

B. Dyeing in the Padding Machine.

Dyeing in the Padding Machine.

This operation may be carried out according to two methods, viz:

1. By dyeing in a similar manner as in the jigger. Give the moist or dry goods, which have been previously boiled out, 2—6 passages, working then under exactly the same conditions, and employing the same quantities of dyestuff and other ingredients as stated on pages 121—126.

2. By the padding process, in which case the goods are not wetted before entering the liquor.

3—16 oz dyestuff for pale shades
1—3 lbs dyestuff for medium shades
3—6 lbs dyestuff for dark shades
8—10 lbs Immedial Black conc. for Black
and in addition double the weight of sodium sulphide crystals and 3 oz Turkey-red oil

per 10 gallons liquor.

Dissolve the dyestuff with the sodium sulphide in hot water and only then add the Turkey-red oil to the bath.

The padding is done in a hot bath, best heated with closed steam. Proportionately to the quantity of liquor absorbed in dyeing, the bath is replenished with a fresh supply of liquor that has been prepared exactly like the starting bath.

For mercerised goods one single passage proves sufficient as a rule, whereas unmercerised goods, and such as are dyed a deep shade, require at least two passages.

When producing blacks, it is recommended to add to the dyebath 8 oz dextrine and 8 oz Glauber's salt in addition to the quantities of dyestuff, sodium sulphide and Turkey-red oil above-stated; two passages prove sufficient in this case. In case blacks are to be produced exclusively, it is advisable to employ a rather big trough.

After dyeing, the goods are rinsed thoroughly, the black dyeings especially with the addition of 5—8 oz acetate or formate of soda per 10 gallons liquor to the last rinsing bath.

C. Dyeing in the Continuous Machine.

Dyeing in the Continuous Machine.

The continuous machine is principally used for a large production.

A description of this machine will be found on page 27 (sketch 29).

For a passage lasting 3—4 minutes from the time of entering the goods until they leave the vat again, the following quantities are necessary:

Immedial Black.

Starting bath:

2 —2½	lbs	Immedial Black NNG conc.	per 10 gallons liquor.
2 —2½	lbs	sodium sulphide crystals	
4½—8	oz	soda ash	
1½—3	oz	Turkey-red oil	
2 —2½	lbs	common salt or desiccated Glauber's salt	

During the dyeing the bath is replenished with:

5,5—6,5 %	Immedial Black NNG conc.	calculated on the weight of the goods to be dyed.
5,5—6,5 %	sodium sulphide crystals	
0,5 %	soda ash	
0,5 %	Turkey-red oil	
1 —2 %	common salt or desiccated Glauber's salt	

Dye at boiling temperature with only one passage. After thoroughly pressing off, enter the dyed goods into the adjoining rinsing vats, complete washing in a small broad-washing machine as quickly as possible, and finally treat in a bath charged with 5—8 oz acetate or formate of soda per 10 gallons liquor.

Immedial Indone.

Starting bath:

6 oz— 1½ lbs	Immedial Indone	per 10 gallons liquor.
12 oz— 3 lbs	sodium sulphide cryst.	
3 oz— 6 oz	soda ash	
1½ oz— 3 oz	Turkey-red oil	
3 oz— 11 oz	glucose	
8 oz— 2 lbs	common salt or desiccated Glauber's salt	

During the dyeing operation the dyebath is replenished with:

1,5— 8 %	Immedial Indone	calculated on the weight of the goods to be dyed.
3 —16 %	sodium sulphide cryst.	
0,5— 1 %	soda ash	
0,5 %	Turkey-red oil	
1 — 2 %	glucose	
2 — 3 %	common salt or desiccated Glauber's salt	

Dye with one passage at 120—140 deg. F. (50—60° C.). Having passed the two dye vats, the goods are given an air passage over some guiding rollers fixed above the vat, in order to oxidise, and then entered into the rinsing vat.

Immedial Direct Blue or Immedial Indogene.

Starting bath:

4½ oz—12 oz	Immedial Direct Blue B extra conc.	per 10 gallons liquor.
9½ oz— 1½ lbs	sodium sulphide cryst.	
3 oz — 6 oz	soda ash	
1½ oz— 3 oz	Turkey-red oil	
4½ oz— 2 lbs	common salt or desiccated Glauber's salt	

During the dyeing the dyebath is replenished with:

2 — 5 %	Immedial Direct Blue B extra conc.	calculated on the weight of the goods to be dyed.
4 10 %	sodium sulphide cryst.	
0,5 — 1 %	soda ash	
0,5 %	Turkey-red oil	
2 — 3 %	common salt or desiccated Glauber's salt	

Dyed like Immedial Black near boiling temperature with one passage; the goods are then entered straight into the rinsing vats.

Immedial Blue or Immedial New Blue.

Starting bath:

6 oz — 12 oz	Immedial Blue CR extra conc.	per 10 gallons liquor.
12 oz — 1½ lbs	sodium sulphide cryst.	
6 oz — 8 oz	caustic soda lye of 77 deg. Tw.	
1½ oz — 3 oz	Turkey-red oil	
8 oz — 2 lbs	common salt or desiccated Glauber's salt	

During the dyeing the dyebath is replenished with:

2 6 %	Immedial Blue CR extra conc.	calculated on the weight of the goods to be dyed.
4 — 12 %	sodium sulphide cryst.	
0,25 — 0,5 %	caustic soda lye 77 deg. Tw.	
0,5 %	Turkey-red oil	
2 — 3 %	common salt or desiccated Glauber's salt	

The dyeing is conducted with one passage at boiling temperature. The goods are then squeezed off well, beamed or plaited down, and, without being rinsed, developed either by smothering or steaming with the admission of air; thereupon they are rinsed hot.

Developing of Immedial Blue or Immedial New Blue.

Developing of Immedial Blue or Immedial New Blue.

The developing may be carried out either by steaming with the admission of air, or by smothering.

Developing by steaming with the admission of air.

The goods after dyeing are squeezed off very thoroughly, and, without being rinsed, steamed for 20 30 minutes with the admission of air, and then rinsed hot.

The steaming may be done in any steaming apparatus or wooden chest, provided that air is introduced simultaneously by means of an air injector. See sketch 32 (page 28 and 29) and sketch 35 (pages 118 and 119) The bark described in sketch 35 should be of a littler greater width than the pieces to be steamed. For a detailed description of the method of working to be followed see page 118 120.

Developing by Smothering.

The pieces may be developed by simply storing them in a warm place. After dyeing and squeezing off they are given a short air passage and are then beamed at once. The rolls of cloth are covered with a moist forerunner or with a layer of oiled paper, so as to preclude a drying up. In this way the goods are left lying overnight in a room heated to 120—160 deg. F. After having been developed, the goods are rinsed hot.

Aftertreatments with Metallic Salts with Acetate of Soda.

Aftertreatment with Metallic Salts; Aftertreatment with Acetate of Soda.

The methods are described on page 112.

Topping Immedial Colours with Indigo.

Topping with Indigo.

The various brands of the

Immedial Blues and *Immedial Direct Blue*

are used very largely for bottoming and subsequent topping with Indigo. For the production of deep shades, the latter may be used in combination with the various *Immedial Blacks*, especially with

Immedial Brilliant Black 5 B V conc.

The dyeing is done as customary, likewise the topping with Indigo which may be carried out in any Indigo vat.

It is in this case not necessary to specially *develop the Immedial Blue.*

Chapter IX.

Paranitraniline Red.

Paranitraniline Red, owing to its simpler method of application and its excellent properties of fastness is steadily gaining in favour as a substitute for Alizarine-Red on cotton yarn and cotton piece-goods.

The colour penetrates the fibre thoroughly and is distinguished by very good fastness to light, washing, chloring and acids; it is in no way inferior to Alizarine-Red in fastness to rubbing, especially in the case of piece-goods.

Paranitraniline Red is produced in a special manner by first impregnating or mordanting the cotton material with an alkaline solution of Beta Naphtol, and after drying, developing the Red in a solution of diazotised Paranitraniline.

The following methods are the best for obtaining reds of either a more yellowish or a more bluish tone.

1. Mordanting with Beta Naphtol or Naphtol RC.

The bluest shade of red is obtained by using Naphtol RC.

2. Neutralising the diazo solution either with caustic soda alone, or with caustic soda and acetate of soda, or with acetate of soda alone.

By neutralising with caustic soda lye alone, a somewhat more yellowish red will result, but the diazo solution will keep much better and the expense is lower than when working with acetate of soda. By using acetate of soda alone the shade of the red will turn out the bluest.

In producing this exceedingly valuable red colour exact working according to the following instructions is very important. Otherwise the results might be not satisfactory.

Special care should be taken that the hydrochloric acid and the caustic soda lye are of exactly the strength indicated. A good red can only be expected with certainty if the stated proportions are strictly adhered to.

The Dyeing of Paranitraniline Red on Cotton Yarn.

Preparation of the Yarns.

Preparing. It is recommended as a rule to first boil the yarns with the addition of some carbonate of soda or caustic soda, and to rinse and dry well.

In a good many cases however the yarn is mordanted at once without previous boiling off, but care has then to be taken that it is very thoroughly penetrated during the mordanting and developing.

Mordanting with Beta Naphtol and Naphtol RC.

Mordanting. The yarn is mordanted either in a trough as shown in the sketch below, or in a tramping machine of the kind used frequently for Alizarine Red. (Sketch 36).

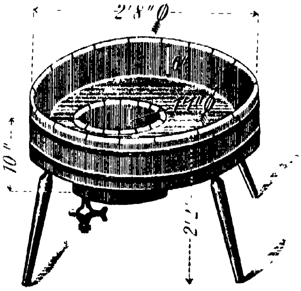


Fig. 36.

The mordanting bath is prepared as follows:

For 100 lbs cotton yarn:

I. 1000 grms. (2 lbs 3¼ oz) Beta Naphtol or Naphtol RC
are mixed with
1000 grms. (2 lbs 3¼ oz) caustic soda lye of 75° Tw., then
10 litres (2¼ gallons) boiling water are added, and the
whole is stirred until dissolved.

In another vessel,

II 2500 grms. ($5^{1}/_{2}$ lbs) castor-oil soap*) are dissolved in
10 litres ($2^{1}/_{4}$ gallons) boiling water.

An equal quantity of Turkey-red oil may be used in the place of castor-oil soap; with the latter, however, somewhat bluer and brighter shades are obtained.

Mix Solutions I and II, and dilute to **60 litres ($13^{1}/_{4}$ gallons).**

Fill the trough with 15 litres ($3^{1}/_{2}$ gallons) of this mordanting liquor, which should be lukewarm (about 40° C. or 105° F.), pass 2 lbs of the yarn through the same, add 900 cc. ($1^{9}/_{16}$ pints) more of the mordanting liquor, pass another 2 lbs of yarn through, and so on until the whole lot of 100 lbs has been passed. Then pass the yarn in lots of 2 lbs at a time once more through the same liquor, wring off, wrap it up in light cotton cloth (calico), and hydroextract well for 15 or 20 minutes.

Drying.

The yarn is then hung up rather loosely over square sticks (not more than 1 lb for each stick) and sharply dried, which is best done over night.

The drying rooms best adapted for this purpose are large wooden boxes about 2 yards wide and $3^{1}/_{2}$ yards high and well isolated with infusorial earth, the front wall of which is provided with sliding doors. Lengthways two poles are fixed for supporting the square sticks carrying the yarn. Iron pipes heated by steam are arranged at the bottom of the box.

This special arrangement is very much to be recommended because the required temperature cannot be obtained in the ordinary drying chambers and the yarn mordanted with Naphtol must be dried separately in order to prevent the yarns from coming into contact with acid vapours, whereby the colour might become spotted or streaky.

---

*) Castor-oil soap is prepared as follows:

10 kilos (20 lbs) castor-oil (of the first pressing) are well mixed with,

$8^{1}/_{2}$ „ (17 lbs) caustic soda lye of 36° Tw., and boiled for 1 hour; after about 5 hours, when the soap is cooled off to some extent,

2,2 „ (4 lbs 14 oz) hydrochloric acid of 32° Tw., are added; the whole is boiled again for $^{1}/_{2}$ hour, and after it has become cool, the solution of salt formed is drawn off.

It is advisable for small etablishments to buy the castor-oil soap ready for use, as it is manufactured in good quality by most makers of Turkey-red oil and is hardly any more expensive than the product prepared by the dyer himself.

The prepared and well dried yarn should be developed with the least possible delay with diazotised Paranitraniline.

The yarns have to be protected from moisture and wetting before as well as after the drying, as spots and streaks are otherwise apt to result.

Developing with Paranitraniline C.

For 100 lbs of yarn.

Developing Liquor.

Liquor A.

850 grms. (1 lb 14 oz) Paranitraniline C are well mixed with
3 litres ($5^1/_4$ pints) boiling condensed water and dissolved with
2 litres ($3^1/_2$ pints) hydrochloric acid of 32° Tw.

This acid solution is run in a thin stream while constantly stirring into
20 litres (about $4^1/_2$ galls.) water which should be the coldest procurable (or be mixed with small pieces of ice, see below), whereby the hydrochloride of Paranitraniline is separated in form of fine crystals.

After the solution has been cooled off to at least 57° F. (14° C.).
500 grms. (1 lb $1^9/_{16}$ oz) nitrite of soda dissolved in
2 litres (about 4 pints) cold water are poured in in one lot while stirring and the clear solution resulting after about 10 minutes is diluted to
42 litres ($9^1/_4$ (gallons).

In another vessel,

Liquor B.

570 cc. (1 pint) caustic soda lye of 75° Tw. or 1420 cc. ($2^1/_2$ pints) of 36° Tw. are diluted with cold water to
18 litres (4 gallons).

Or, if a more bluish red is required,

Liquor BI.
500 cc. ($^7/_8$ pint) caustic soda lye of 75° Tw. or 1250 cc. ($2^3/_{16}$ pints) of 36° Tw. are diluted with cold water to
$7^1/_2$ litres (1 gall. 5 pints) and mixed with a solution of
1 kilo (2 lbs $3^1/_4$ oz) acetate of soda dissolved in
$7^1/_2$ litres (1 gall. 5 pints) cold water, and the whole is diluted to
18 litres (4 gallons).

Or, for producing a still bluer shade of red,

Liquor BII.
2 kilos (4 lbs 7 oz) acetate of soda are dissolved in
18 litres (4 gallons) cold water.

Developing.

For developing, take 7 parts of Liquor A and 3 parts of Liquor B, and work in a trough similar to that recommended for mordanting, but a little larger (the sump being about 16 inches in diameter and 10 inches deep and holding about $6^1/_2$ gallons).

Charge this trough with 12 litres (2 gallons 5 pints) of the coldest water procurable (adding, if necessary, small pieces of ice, see below), 10 litres ($2^1/_4$ gallons) of Liquor A and $4^1/_3$ litres ($7^5/_8$ pints) of Liquor B, BI or BII.

Pass 2 lbs at a time of the mordanted and dried yarn through this mixture, wring off, pass through again (altogether about 1 minute), and wring off finally.

Then add 630 cc. ($1^1/_8$ pint) of Liquor A and 270 cc. ($^1/_2$ pint) of Liquor B, BI or BII, develop again 2 lbs of the yarn at a time, and continue working in this manner until the whole of the 100 lbs are developed.

The developing like the mordanting may also be carried out to advantage in a tramping machine.

Then put the yarn on ordinary yarn sticks, rinse thoroughly, and soap boiling hot.

By the hot soaping the red turns considerably bluer. The soaping may be repeated to advantage, in which case the yarn is given a hot rinsing bath in between.

Remarks. The first lots of the red may sometimes show yellowish bars, which are chiefly due to the wooden sticks used for drying the mordanted yarn not being sufficiently impregnated yet with the Naphtol solution. It is therefore recommended to impregnate fresh sticks before use with a solution of Beta Naphtol or Naphtol RC.

The proportions for preparing the diazo solution of the Paranitraniline (Liquor A) have been so calculated that no ice is needed for diazotising if very cold well water available. It is however, advisable to add small pieces of ice to the water for preparing the diazo-solution and to the trough, especially if the temperature of the dye-house is higher than 20° C. (68 deg. F.), 10 lbs ice replacing 1 gallon water.

The Dyeing of Paranitraniline Red on Cotton Piece Goods.

The pieces are impregnated with a solution of Beta Naphtol or Naphtol RC and dried in a hot flue or on a tentering frame. They are then passed through the developing bath and finally well rinsed and soaped. In the absence of a hot flue or tentering frame the pieces prepared with Beta Naphtol may also be dried on drying cylinders, for which purpose, however, the first cylinders must be well wrapped with cotton cloth.

Mordanting with Beta Naphtol and Naphtol RC.

Mordanting.

In a suitable vessel (barrel or bucket)

2 kilo 450 grms.	(4 lbs 14½ oz)	Beta Naphtol or Naphtol RC are mixed with
2 kilo 500 grms.	(5 lbs —)	caustic soda lye of 75° Tw.
3 kilo 750 grms.	(7 lbs 8 oz)	boiling hot water and then
3 kilo 250 grms.	(6 lbs 8 oz)	cold water are added and finally
5 kilo —	(10 lbs --)	castor oil soap*) dissolved in
25 litres —	(5 galls.-)	hot water. The whole is diluted with cold water to
100 litres	(20 galls.).	

If a more yellowish Red is desired, Beta Naphtol is used and Naphtol RC for a more bluish Red.

The pieces are best impregrated with the Naphtol solution in the padding machine. The trough is filled with the Naphtol solution which is replenished in proportion to the quantity absorbed by the pieces. The pieces should be developed as soon as possible after the preparing and drying.

Previous to impregnating, the pieces are well boiled or bowked and then dried.

---

*) Regarding castor oil soap see page 137.

Developing with Paranitraniline C.

Developing. The developing of the mordanted and dried pieces is best carried out in a padding machine as shown in sketch 37.

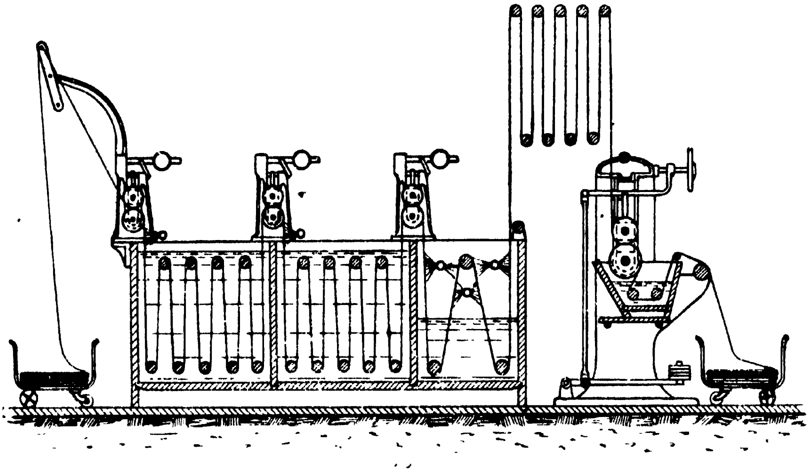


Fig. 37.

Liquor A.	1 kilo 400 grms.	(2 lbs 13 oz	) Paranitraniline C are mixed with
	10 litres	(2 galls.	) boiling hot water and perfectly dissolved by the addition of
	3 litres	(5¼ pints	) hydrochloric acid 32° Tw. This solution is stirred into cold water and cooled off to at least 50—60° F. by adding a sufficient quantity of small pieces of ice. Then
	7 litres 800 cc.	(1 gall. 4½ pints)	solution of nitrite 1:10 are added. The clear solution obtained after a few minutes is diluted with cold water to
	[illegible]		
	75 litres	(15 galls.	

In another vessel

Liquor B.
3 kilo (6 lbs) acetate of soda are dissolved in
20 litres (4 galls.) cold water and diluted to
25 litres (5 galls.)

For developing

3 parts of Liquor A and
1 part of Liquor B are used.

The trough of the machine is filled with the developing liquor, the temperature of which should not exceed 55 or 60 deg. F. (13 - 16° C.) and while passing the goods through, fresh solution corresponding to the quantities used up (3 parts A and 1 part B) is added.

After passing through the developing liquor and well pressing between the squeezing rollers, the pieces are taken over guiding rollers through the air for several yards to give the dye time to develop completely. They are then passed through several washing boxes, then soaped boiling hot, and rinsed well.

The patterns below show cotton cloth dyed with

Paranitraniline Red.

CTOR OF INDUSTRIES
LIBRARY
JAN. 1923
BENGAL